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Electronic Business®

CFO survey suggests modest growth for second half of 1987

Consumer electronics: A new product blitz from Japan

Southern California

The new electronics mecca

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MIDYEAR UPDATE

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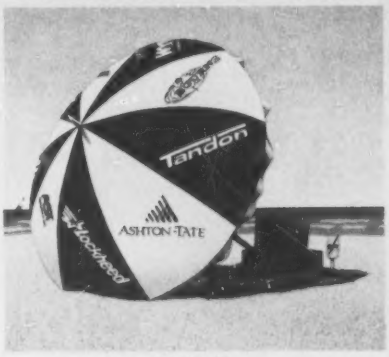

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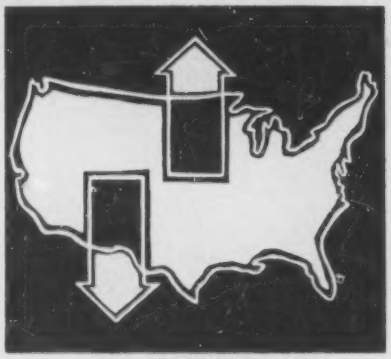

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VBPA ABP

Nursing the bottom line back to health

Chip makers should be leading the recovery. DEC was on a diet and wants to stay lean

A survey by the *Wall Street Journal* of more than 500 companies shows that their net income increased in the first quarter by 11% over the year-earlier quarter. That was no small accomplishment, in fact it was twice as good as what electronics companies managed for that quarter. The ELECTRONIC BUSINESS Index for profits, which tracks net income by a group of 16 companies we deem representative of the U.S. electronics industry, increased by 5.5%, on revenue growth of 11%.

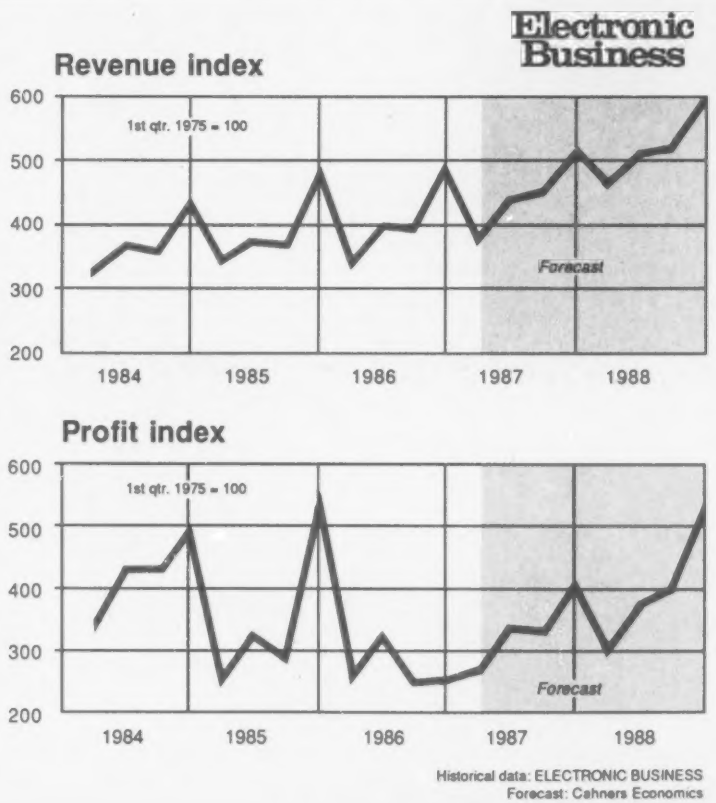
Actually, 5.5% was nothing to be ashamed of either, especially after the profit declines of recent years. If the current forecast by Cahners economist Cheryl Patstone comes to pass, our profit index in 1987 will increase by 25% (a performance second only to 1984's) thus making up all the ground it lost in 1986, the worst year for profits in memory for the electronics industry.

This is remarkable considering that Cahners Economics forecasts only a 10% growth in revenue for the whole year, about the same gain as in the first quarter, and shows how effective electronics companies have been at cost cutting.

Of the companies in our sample, one of the first to have reined in on costs was Digital Equipment Corp. To its credit, DEC did so long before the recession set in. Aided by successful strategies in its VAX line of departmental computers and workstations, which has swelled its revenue by 25% in the first quarter, DEC's trim operation catapulted its net income to 81% growth. "We have achieved our profit improvement over the last few years by holding down our rate of growth in costs," says vice president for finance Jim Osterhoff. DEC, as well as IBM, has held the size of its manufacturing workforce practically constant for the past five years, while most electronics companies increased employment during the 1983-84 boom and had to lay off employees or trim payrolls in 1985 and 1986. For example, reporting that Hewlett-Packard Co.'s cost of goods sold dropped in the first quarter to 46.5% of net revenue (from approximately 49% in 1985), president John Young acknowledged the contribution from the voluntary workforce reduction programs implemented in 1986.

The most visible symptom of a solid recovery in 1987 is in the improving of bottom lines by semiconductor manufacturers. Intel's swung into the black in the first quarter, on a revenue gain of 41%. AMD's is still red, as its sales increased only 11%, thus matching the revenue growth by the group of companies. This has tempered the enthusiasm over the strength of this recovery because sales of components, especially semiconductors, usually lead the electronics market recovery. A healthy bottom line, therefore, will be foremost in managements' minds for 1987. "Basically, we've been on a diet," says DEC's Osterhoff. "Let's not put the fat back on. Let's stay lean and productive."

ALBERTO SOCOLOVSKY



Historical data: ELECTRONIC BUSINESS
Forecast: Cahners Economics

Steady growth expected

The United States Index of Industrial Production, a coincident indicator of the U.S. economy, has been climbing steadily since the summer of 1986. The fourth quarter was up 0.7% from the prior quarter bringing yearly production up 1%. This year, modest gains are expected to continue through midyear (first quarter production rose by 0.6%) with sharper increases in industrial production expected in the third and fourth quarters.

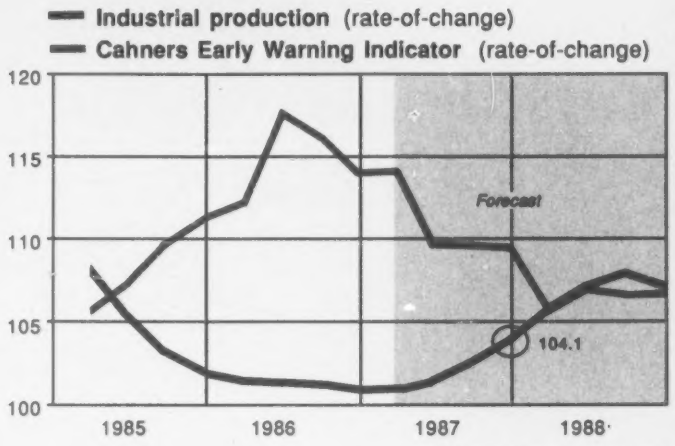
The Cahners Early Warning Indicator (CEWI) is a weighted average of housing starts, the Dow Jones Industrial Stock Index and the money supply (M2) — deflated by the Consumer Price Index. It forecasts probable business cycles about 12 months in advance. The black curve is a plot of the 12-month rate-of-change Index of Industrial Production. That is, its change over a 12-month period can be determined by comparison with the line at 100. For example, the 104.1 level forecasts using the CEWI for the end of this year indicates that the average for all of 1987 should be 4.1% above 1986.

Readers can obtain a brochure explaining the CEWI method from Cheryl Patstone, editor of the Electronic Business Forecast *newsletter, Cahners Publishing Co., 3021 Tisch Way, Suite 100, San Jose, Calif., 95128.*

ATE revenue and profit

In the final quarter of 1986, revenue for automatic test equipment manufacturers showed an 6.8% increase from the prior quarter and was up 10.6% from the year-ago quarter. The gradual improvement in the second half of the year, when demand from computer and semiconductor manufacturers for automatic test equipment showed signs of strengthening seems to signal a climate of cautious expansion. Despite this improvement in the second half of 1986, annual revenue fell 6.7% the second year in a row of declining sales (1985 revenue fell 14.4%). This year a 10.0% increase is forecast, followed by a sharp 25.8% rise in 1988. ATE manufacturers continued to rack up losses into the first quarter of 1987. A return to profitability is expected during the second half of the year.

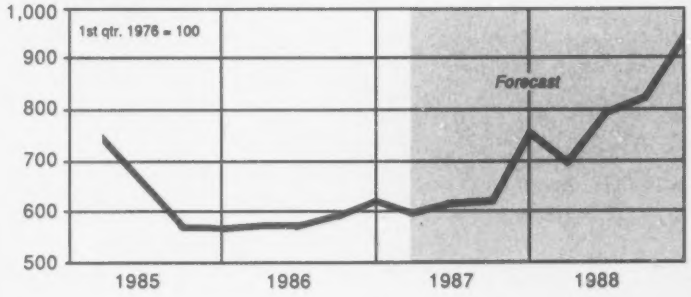
Economic indicators



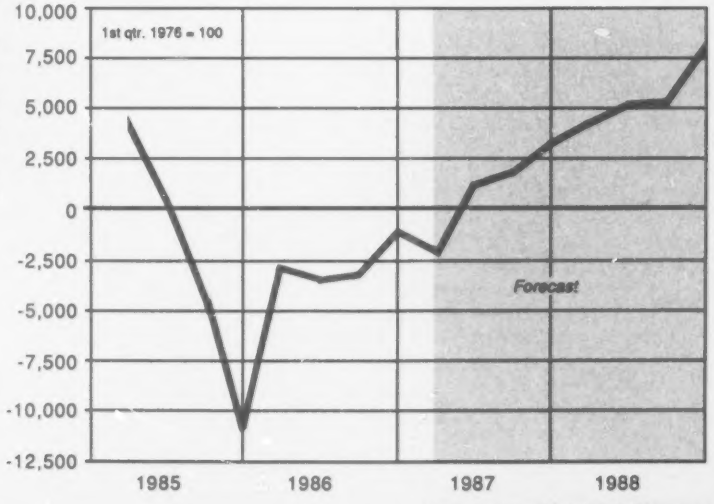
Historical data: Federal Reserve Board
Forecast: Cahners Economics

ATE indexes

Revenue



Profits



Historical data: ELECTRONIC BUSINESS
Forecast: Cahners Economics

BUSINESS BAROMETER FORECAST

Electrical machinery

(SIC 36)

	1985	1986	Forecast 1987	Forecast 1988
New orders ($ billions)	$200.35	$207.80	$217.69	$248.08
Shipments ($ billions)	$192.73	$205.61	$212.08	$234.32
Unfilled orders* ($ billions)	$90.36	$92.57	$98.18	$11.94
Inventory/shipment ratio	2.44	2.28	2.18	2.19

Historical data: U.S. Department of Commerce

Electronic components

(SIC 367)

	1985	1986	Forecast 1987	Forecast 1988
New orders ($ billions)	$40.46	$43.17	$49.20	$59.55
Shipments ($ billions)	$42.92	$44.01	$48.62	$56.62
Unfilled orders* ($ billions)	$16.47	$15.63	$16.21	$19.14
Inventory/shipment ratio	2.25	2.09	1.96	1.96

Historical data: U.S. Department of Commerce

Office and computing equipment

(SIC 357)

	1985	1986	Forecast 1987	Forecast 1988
New orders ($ billions)	$61.60	$54.32	$59.99	$74.37
Shipments ($ billions)	$62.22	$56.23	$59.22	$69.44
Unfilled orders* ($ billions)	$20.54	$18.63	19.40	24.33
Inventory/shipment ratio	2.50	2.35	2.13	2.15

Historical data: U.S. Department of Commerce

Communication equipment

(SIC 366)

	1985	1986	Forecast 1987	Forecast 1988
New orders ($ billions)	$75.97	$73.22	$71.98	$79.55
Shipments ($ billions)	$65.39	$69.73	$72.52	$77.46
Unfilled orders* ($ billions)	$65.79	$69.29	$68.75	$70.84
Inventory/shipment ratio	2.93	2.83	2.66	2.65

Historical data: U.S. Department of Commerce

Semiconductor shipments

Integrated circuit shipments

	1985	1986	Forecast 1987	Forecast 1988
U.S. market ($ billions)	$6.61	$6.93	$8.09	$10.61

Discrete semiconductor shipments

	1985	1986	Forecast 1987	Forecast 1988
U.S. market ($ billions)	$1.48	$1.58	$1.70	$2.03

Total semiconductor shipments

	1985	1986	Forecast 1987	Forecast 1988
U.S. market ($ billions)	$8.09	$8.51	$9.79	$12.65

Historical data: Semiconductor Industry Association

Industrial production

(Seasonally adjusted index, 1977 =100)

	1985	1986	Forecast 1987	Forecast 1988
Electronic components	258.1	244.1	268.4	317.4
Scientific and engineering instruments	156.6	163.2	170.8	187.1
Office and computer machines	265.4	256.6	271.0	307.6
Communication equipment	217.9	216.7	224.3	243.5
Defense and space equipment	170.7	180.3	188.8	192.4
Aircraft and parts	140.4	157.7	166.7	165.5
Total index	123.8	125.1	130.2	139.3

Historical data: Federal Reserve Board

Producer price indexes

Components (1967 = 100)

	1985	1986	Forecast 1987	Forecast 1988
Electronic components and accessories	197.9	201.5	206.6	213.7

Passive components (Dec. 1967 = 100)

	1985	1986	Forecast 1987	Forecast 1988
Capacitors	188.8	184.2	185.7	191.8
Resistors	188.7	192.4	194.6	194.9
Connectors	234.7	242.9	257.9	275.6

Active components (Dec. 1974 = 100)

	1985	1986	Forecast 1987	Forecast 1988
Digital bipolar ICs	60.4	62.4	65.0	69.5
Digital MOS ICs	35.9	32.4	32.3	33.6
Linear ICs	60.4	57.3	56.0	57.7

Historical data: Bureau of Labor Statistics

Plant utilization

(Average percentage of capacity utilized)

	1985	1986	Forecast 1987	Forecast 1988
Electrical machinery	74.7%	71.5%	72.3%	77.6%
Instruments	82.5%	80.5%	78.6%	81.7%
Aerospace	82.3%	87.7%	78.6%	81.7%

Historical data: Federal Reserve Board

* Year-end figures

Forecasts: Cahners Economics

The "ELECTRONIC BUSINESS FORECAST" newsletter is available from Cheryl Patstone, Cahners Publishing Co., 3021 Tisch Way, Suite 100, San Jose, Calif. 95128

From digital audio to fiber-optic wedding dresses

What's new in the land of consumer electronics? Look for a blitz of new products in Japan

Trouble getting to sleep on hot summer nights? Try an electronically cooled pillow. Hitachi Ltd., Matsushita Electric Industrial Company Ltd. and Toshiba Corp. all have new high-tech pillows on the market that use semiconductor elements to absorb body heat, keeping the pillow several degrees cooler than the head. Retail price: around $150.

That's just one of an avalanche of new consumer electronics products to hit the Japanese market in the last few months. Japanese consumer electronics producers have had nearly two years now to come up with new strategies for coping in the world of the high yen and to start implementing them. They have been scrambling to cut costs and to come up with new, higher value-added products. And now these new products are starting to hit the marketplace.

Sleep tight! Keeping cool with microprocessor-based electronic pillows

One popular line of effort is applying electronics technology to traditional low-technology household products, like the pillow, or even the Japanese household shrine.

This high tech permeates into the kitchen also. How about waking up in the morning to freshly baked bread? Many Japanese families have an automatic rice cooker, which they set before going to bed at night to have rice ready for breakfast in the morning. An enterprising Japanese inventor has come up with a bread baker that works in much the same way. Put in flour, water and yeast before retiring, and semiconductor sensors control the rising and the baking to have the bread ready for breakfast. The entrepreneur's model will be sold under the Funai brand. Matsushita has just rushed out its own $250 version.

Then there's the fiber-optic wedding gown. The major wedding attire producer Tomita Aishoji weaves optical fibers into its top-of-the-line "Milky Way" gown, for a special twinkling effect at candlelight weddings. The company says that the bride will hardly notice the dress's built-in battery pack.

Electronic altars

Even the Japanese family's household altar has gone electronic. Japan Art Memory sells an automatic model for around $675. Clap twice and the doors on the small shrine open, the interior lights up, and a recorded prayer plays. Both Buddhist and Shinto models are available.

The consumer electronics companies are also working hard to upgrade their existing electronics products with new features to make them ever more convenient.

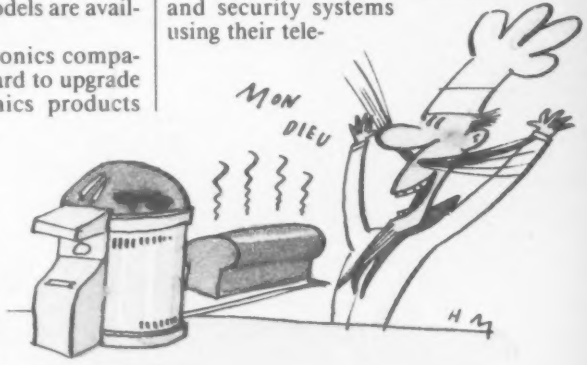
Having trouble finding a place in the kitchen to put the microwave oven? Sharp Corp. has a new refrigerator with the microwave oven built right in between the freezer and the refrigerator. Take dinner from the freezer and pop it into the microwave without moving a step. Several companies are offering new microwaves that resemble oversized casserole dishes, designed to sit on the kitchen table. Sharp also has a microwave for those who don't like programming all of those complicated numbers into the touch panel — it comes with a bar code reader that can read the bar-coded cooking instructions directly from the accompanying cookbook.

Don't like to fiddle with all those buttons on a digital watch? Citizen Watch just introduced a new voice-controlled model. Just tell it to set the alarm for seven o'clock, and it does. Or ask for the date or a phone number, and the watch displays the correct digits. Citizen expects the watch to sell for around $75.

Would you like to send a memo from your car? Mitsubishi Electric Corp. has a facsimile machine that fits under the dashboard and runs off your car battery.

Is it too much trouble to use a home computer to control the household appliances and security system? Matsushita is selling a $700 wall wiring system to developers allowing homeowners to control appliances and security systems using their tele-

Hal Mayforth



The yeast of life: Automatic breadmakers from Matsushita et al

vision screen and remote control unit.

Are you too tense from dealing with all of this gadgetry? Relax with the ultimate stereo system that delivers not only music, but also massage and oxygen-enriched air. At around $9,000, the producer thinks the system will be a little expensive for the average consumer, so it is targeting highly stressed executives. The system is made by semiconductor gas maker Japan Oxygen Inc.

Don't laugh. The Japanese consumer electronics industry may be declining, but this blitz of new products suggests that it isn't dead yet. Indeed, pressure from the high yen may have spurred a new round of innovation that will pep up demand.

"Consumer electronics trends are set in Japan these days," says Daniel

"Get over here!" Watches you can talk to and watches that talk back

Infanti, manager of corporate marketing and spokesman for Sharp Electronics Corp. in Mahwah, N.J. "And the only way to survive long term is to come up with something a little different."

Although exports have plummeted, domestic Japanese sales of consumer electronics are chugging along quite nicely, thank you, largely due to the success of upgraded models. Domestic sales of color televisions were up about 8% in each of the first two quarters of 1986, compared with the same periods the previous year, according to industry association figures compiled quarterly by the industrial daily, *Nikkei Sangyo Shimbun*. Japanese sales of video tape recorders were up 18% in the first quarter, 20% in the second. Sales of stereo equipment were up about 10% in each quarter, propelled by strong demand for small compact disc (CD) component systems. Demand for Japanese language word processors, largely from consumers, was up 20% each quarter, with producers operating at 100% capacity. Not coincidentally, it was Toshiba, the market leader in these lap-top word processors, that introduced a successful lap-top computer with a readable screen in the U.S. market.

Japanese consumers are snapping up home computers, too. Nintendo Co. claims that its inexpensive family computer has reached 30% penetration of all Japanese households, as company revenue climbed nearly 30% last year, to almost $670 million. Most of these units were purchased to play video games, but now Nintendo is coming up with new software to enable users to design and knit sweaters with a knitting machine attachment, buy and sell stocks through a network developed jointly with Nomura Securities Company Ltd., and also play exercise games where movements on a sensitive mat influence action on a computer screen.

The new product with the biggest potential market, of course, is the dig-

Do you take this light bulb? A fiber-optic wedding dress — ideal for candlelit weddings

Consumer products still drive chip sales in Japan and in the rest of the world outside of the U.S.

Percentage of IC use by sector for 1986

	U.S.	Japan	Europe	Rest of world
Military	15%	—	5%	—
Industrial	12%	10%	18%	13%
Telephony	18%	18%	27%	14%
Consumer/automotive	15%	39%	30%	53%
Computer	40%	33%	20%	20%
Total ($ billions)	**$13.2**	**$11.5**	**$6.5**	**$2.7**

Includes captive production

Source: Integrated Circuit Engineering

Ahhhhh!! A stereo system to massage you and also provide oxygen-enriched air

Hal Mayforth

ital audio tape player, which many hope will be the next blockbuster consumer product to reach annual sales of ¥1 trillion, or $6 million to $7 million, by the early 1990s. But some major problems must be solved first.

The first problem is price. At the initial price in Japan of around $1,200 to $1,300, Matsushita estimates all producers together will sell only about 50,000 units total this year. And prices of DAT players aren't likely to fall nearly as quickly as those of compact disc players, with the high yen squeezing margins and one digital player already in people's living rooms. "DAT will come in at a high price for the audiophile," predicts Sharp's Infanti. "With the high yen, price erosion is going to happen a lot more slowly in the future. It may be years before DAT is available for the masses."

Then there's the problem of software. Recording companies don't want to make commercial tapes for the DAT players unless there is some safety mechanism to prevent the making of perfect DAT recordings. But users don't want to buy players if there's no software to play on them. Nor do they want to buy tape recorders that won't record.

The DAT player producers are trying out a compromise solution in Japan — by making the new units able to record, but not perfectly. The DAT players now on the market use a different sampling frequency than compact disc players, so they cannot make a direct digital recording from a CD. They also contain a digital flag code recognition system, so that they can't copy commercially recorded and flag-coded digital tapes. However, the DAT players can digitally record the analog output of the digital source. Matsushita Electric Industrial officials claim that this digital-analog-digital recording is about 98% the quality of a digital-digital copy — good enough to please the audiophilea when making copies for their own use, but not good enough for pirates to use in commercially copying tapes.

The audiophile would probably be satisfied. "In the tests we did before Congress, we played a CD, a digital-analog-digital DAT recording, and a tape [that was] recorded on a high-quality analog Nakamichi Dolby C system," explains Leonard Feldman, technical consultant to the Electronic Industry Association's consumer electronics group and spokesman for the Home Recording Rights Coalition, which includes some of the major Japanese producers. "Nobody could tell the difference, including me."

But the recording industry thinks these DAT copies are too good. It wants the DAT player makers to include a copy code scanner in each machine to prevent any copying of any music containing the code, a notch of sound removed from between the notes. And it is lobbying Congress hard to get some controls put on import of the DAT players.

"DAT is not going to be as big a product as CDs," says Sharil Osgood, an analyst who tracks Japanese electronics for James Capel Securities Inc. in San Francisco. "The U.S. market depends on what action Congress takes. And homes already have CDs. People aren't going to buy both CDs and DATs. I think the Japanese market estimates of ¥1 trillion a year by 1990 are very optimistic."

PAULA DOE

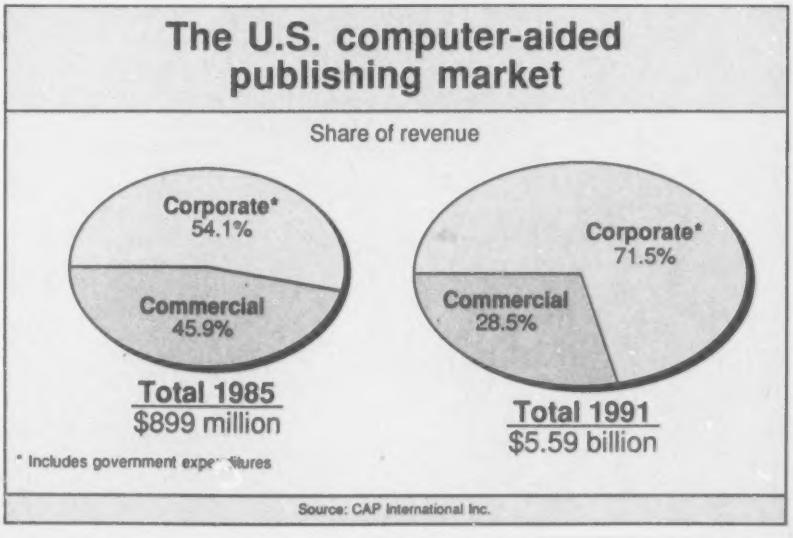
Computer-aided publishing for military applications

Mil-spec documentation systems currently represent between 20% and 30% of the electronic publishing market

There's an old saying in the military specifications business that the product isn't ready until its weight is exceeded by the documentation that supports it. Rockwell International Corp.'s B-1B bomber, for example, has a total of one million pages of documentation. And at $1,000 a page, each manual cost $1 billion to produce. A Navy ship has to carry 15 tons to 25 tons of manuals around with it.

Mil-spec documentation has always been a difficult and awkward side of the publishing business. The sheer magnitude of the preparation, revision, printing and storage of mil-spec information and repair manuals has made the defense industry a prime market for electronic publishing vendors. "It's a demanding type of publishing," says one official at Xyvision Inc., a Wakefield Mass., electronic publishing equipment company which builds high-end systems using proprietary hardware. "You don't send the jet out until the documentation is ready."

First there are the big players, Xerox Corp. and Eastman Kodak Co., which provide the large aerospace companies with specialized publishing systems ranging in cost from $250,000 to $800,000. The second tier, systems costing $50,000 to $100,000, is a highly competitive arena with several vendors using primarily minicomputing systems to sup-



port their software. At the low end is Apple Computer Inc.'s Macintosh and Laserwriter printer, and other systems based on personal computers that can be assembled for about $10,000 to $20,000.

Just how much of the overall electronic publishing market is devoted to mil-spec applications is difficult to determine, says Kenneth Bosomworth, president of International Resource Development Inc., a Norwalk, Conn., market research firm. One of the difficulties of tracking the market is that many military vendors also produce commercial versions of their products, he says.

"If you look at the high-end systems, though, you can see that the mil-spec market is a large part of electronic publishing that the general public doesn't see," Bosomworth says. He estimates that at the high end, 20% to 30% of revenue from system sales would be attributable to military applications, he said.

The middle tier is also active in providing technical publishing systems to military equipment contractors. "Some of our biggest customers are those who do mil-spec publishing," says Michael Mark, director of special projects for Cambridge, Massachusetts-based Interleaf, which produces a publishing system that uses Sun Microsystems Inc. hardware.

The overall electronic publishing systems equipment market produced revenue of $899 million in 1985, according the CAP International Inc., a Marshfield, Mass., market research company that specializes in computer-aided publishing. The company expects that market to swell to $5.59 billion in 1991, with most of the growth occurring in sales to corporations rather than commercial printing concerns.

One of the elements driving the mil-spec market is the Defense Department's intention of completely revising its document standards and the form in which documents are published. In late summer, the DoD will release specifications for a generic text formatting code that the government hopes will bring some order to the dozens of formatting variations now on the market.

New guidelines

The Department of Defense has strict requirements as to how a manual is to be outlined. But every vendor of mil-spec publishing equipment has used different codes embedded in the text to identify the various formats and components of a document. These different "markup tags" make it difficult for the military branches to share the documentation, says Bruce Lepisto, who works for the DoD's office of the assistant secretary for production and logistics in the Weapons Support and Improvement Group. In the past, large pieces of military hardware simply came with their own computerized documentation hardware and software, he says.

Most documents are with proposals that have a long product life, according to Arlene Karsh, director of corporate publishing systems market request services for CAP International. Military equipment, such as a jet engine, could be in use for a decade or more. During that time its design could undergo dozens, if not hundreds, of modifications and updates. Each one of those must be documented in a manual and placed in the proper location. "The ability to append pages and then fold appendages into the rest of the manual is crucial," Karsh says.

New electronic publishing systems that combine graphics, text and layout will make it more feasible for military equipment vendors to bring their publishing operations in-house rather than hire outside services, says Paul Needham, director of marketing for Context Corp., a Mentor Graphics Corp. spin-off in Beaverton, Ore.

"You don't have to have complex typesetters or talented printing professionals," he says. "Everything in military publishing is fairly rigid, so you don't need a highly skilled person to design the manuals."

The demands by the DoD and defense vendors for more advanced computer publishing systems should continue as the technology advances, adds Interleaf's Mark, whose electronic publishing system is based on hardware from Apollo Computer Inc. The military is interested in read-only terminals, he says. Rather than revising a paper manual constantly, the documentation is kept on a database.

DoD's Lepisto says that the military intends to use magnetic disks, tapes and compact laser disks for storage of information on aircraft and vessels. "In a submarine, or especially on a space station, you can carry much more complete technical material than you could with paper manuals," says Lepisto. "If you took all the paper you needed for a space station, you couldn't get it off the ground," he says.

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There is more to California's Southland than sun, surf and sushi. There is also a $23 billion electronics industry.

Southern California

The new electronics mecca

ABOUT THIS TIME OF YEAR, SOUTHERN CALIFORNIANS START WATERING THEIR LAWNS WITH EVEN MORE ZEST THAN USUAL. That's the signal for the Golden State's cold war to erupt in the letters pages as northern Californians lambaste the careless Los Angelenos for sprinkling away the state's precious water.

The war may be about to take a new turn because the Southland's citizens are taking away more than water. They are taking away the San Francisco Bay Area's reputation as America's technology titan.

It is news to many east of the Rockies that Southern California boasts anything more electronic than Disneyland puppets. "It hasn't grabbed attention the way Silicon Valley has," says Edward Marinaro, executive vice president of Irvine, California-based chip maker Western Digital Corp.

Yet the seven-county region, which runs from Santa Barbara, 100 miles north of Los Angeles, to the Mexican border, has quietly outpaced every other high-tech region in America in elec-

BY JOHN KERR

tronics employment, value of shipments and number of firms.

Figures produced expressly for ELECTRONIC BUSINESS by New Jersey-based commercial database Trinet Inc. reveal that Southern California's 219,200 electronics workers last year shipped $23.37 billion worth of equipment. Their 187,000 counterparts in Silicon Valley and environs sold $23.2 billion.

This suits electronics distributors just fine. According to the National Electronic Distributors Association, over 16% of the nation's $7 billion total available market is sourced from three Southern California counties: L.A., Orange and San Diego. L.A. county alone provides 7.4% of that total. Northern California, outsold by the southerners three years ago, merits less, at 14.3%.

Indeed, the lower half of the Golden State has an array of superlatives that would make any Texan eat his hat. Nowhere else is there such a concentration of aerospace and defense-electronics expertise. If the region's five central counties — L.A., Orange, Riverside, San Bernardino and Ventura — were one nation, their gross national product would be exceeded by only 13 countries worldwide.

In an unbridled rush of regional chauvinism, an economic study from the Security Pacific Corp. bank credits the Los Angeles area with the greatest concentration of mathematicians, scientists, engineers, skilled technicians and high-technology industry in the United States.

So think of Southern California as a gigantic bazaar, its myriad businesses importing and exporting more through Long Beach harbor than any other U.S. port except New York City. Its pole position on the Pacific Rim guarantees a pivotal role in development of transpacific electronics trade.

Think of it also as the western Pacific's financial powerhouse, overtaking San Francisco and challenging New York's dominance as commercial bank deposits balloon, as more overseas banks — including Japanese banks — set up shop here and as venture capital proliferates locally.

History buffs have an easy time tracing the Southland's electronics industry back to aerospace roots. Aerospace and defense electronics still symbolize the region in the way that semiconductors are the emblem of Silicon Valley. "The major impetus for this area is the defense community — it creates an incredible number of engineers," says Robert Kelley, president of Southern California Technology Executives Network, (SO/CAL/TEN), a group that convenes local chief executives to solve mutual management problems.

The defense sector also lays off incredible numbers of engineers, as Los Angelenos remember all too well. Although they won't feel a thing when the next semiconductor slump hits — Trinet's figures show only 2.6% of the region's electronics sales coming from chips — they may face tough times should the defense budget be cut further.

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A talented rave

Engineering talent is what Southland electronics executives rave about when asked to list the region's electronics strengths. From San Diego to San Fernando, executives echo this comment from Bourns Inc. corporate vice president Robert McColloch: "If I were to bottom-line it, the key attraction is the pool of talent," he says. That talent, say recruiters, also tends to stay around instead of job-hopping as in Silicon Valley.

Back-to-back sunshine is, of course, a given for Southern California, and an obvious attraction. "The future of technology companies depends on young professionals; to them, quality of life is an important factor, and Southern California offers a lot of that," says Peter Shaw, president of Irvine-based workstation maker Calay Systems Inc.

The sunshine, surf and sand are on tap from Santa Barbara all the way to San Diego. The relative independence of the electronics communities in Santa Barbara and San Diego, not to mention the 200-plus miles that separate them, makes it difficult to pin a cute label on the Southland.

For years, Hollywood's wags have called the region "Tinseltown," or "LA-LA Land." In case those aren't catchy enough, the compulsive nicknamers have tried to bestow upon the area's electronics community the blessing of a memorable moniker such as "Silicon Beach," "Tri-Tech Counties," "Metroplex," even "Silicon Freeway." Mercifully, none will stick.

So in another effort to validate the amorphous high-tech agglomeration, a map of the region is being prepared, similar to the cartoon posters of Silicon Valley that decorate many a cubicle.

The area's sheer size is both a liability and an asset. "Networking" among executives is harder than up north, which is mainly why the SO/CAL/TEN group exists. But many view that as a plus because of the selective anonymity it provides. "In Silicon Valley there are no secrets," quips James Farooquee, president of peripherals maker CMS Enhancements Inc. of Tustin. Explains Western Digital's Marinaro: "You can't build any comfortable personal relationships [in Silicon Valley] because you don't know if they're going to be your competitor."

The region is as diverse as it is large. Beside the 14,000-employee aerospace plants sit tiny firms specializing in everything from factory-automation software to tape drives. Newcomers like FileNet Corp. are finding a niche in document imaging. And even the spin-offs have spin-offs: FileNet staffers left recently to form KoFax, a start-up aiming to provide generic hardware to enable standard personal computers to handle document imaging.

The chain reaction of new company formation does not appear to be as galvanic as in the Bay Area. "It's not yet what I'd call a hotbed of start-up activity," says Kipling Hagopian of Los Angeles venture financier Brentwood Associates. Although the mass is

Marty Braun

decidedly critical, observers believe that entrepreneurial zeal is dampened somewhat by the slow-moving aerospace giants.

Southland enthusiasts say that is not the case. "People have an attitude here that says: 'Let's go do it!'" says Leonard Mackenzie, chairman of computer maker General Automation Inc. There are examples to prove him right: "Gallium Gulch" is a strip of Ventura county northwest of L.A. where several gallium-arsenide specialists have spun off from Rockwell International Corp.

A diverse argument

That diversity sparks some lively dissent among local electronics chiefs: Is it a benefit or not? And does the Southland suffer from not having any core industry like semiconductor production?

The pro-diversity school insists that this difference makes the region's electronics industry more recession-proof. "There's a safety net in the diversity here," says William Conlin, president of graphics company CalComp. Adds Western Digital's Marinaro: "The beauty of it is that it doesn't have a core technology business."

But Fred Cox, longtime Southland entrepreneur and chairman of peripherals maker Emulex Corp., believes that there's a need for more silicon expertise locally because of the engineering benefits that such a basic technology imparts to related industry sectors.

Actually, the Southland has a more solid core than many might think. Semiconductor production permeates invisibly through most of the aerospace giants like Hughes Aircraft Co. and Rockwell.

And the Orange County region could have been a minicomputer hub to rival Route 128 if firms like Computer Automation Inc. and General Automation had not been starved of management skills and venture financing in the late 1960s. "There hasn't ever been a computer company in Southern California that has made it big. There are no Apple Computers down here," says CalComp's Conlin.

Instead, the Southland fields a diverse crew of circuit-board shops, contract-assembly services, test houses, peripherals makers and systems integrators. The infrastructure is nothing if not complete: "It's tremendous — as a new start, you can get any service you want, from clean benches to printed circuit boards to component supply," says Richard Charlton,

Marty Braun

founder of Irvine-based rigid-disk maker Charlton Associates, now Xidex Corp.'s Data Disc division.

In areas like Orange County, it's also easy to find factory and office space. Land developers like the Irvine Co. are tying pristine technology parks in with picturebook residential areas.

But the locale's desirability means it is a costly place to live — and thus to manufacture. Consequently, areas like Orange County focus on short-run, high value-added work with low labor content. The immigrant labor which is widespread through the region has little truck with the electronics industry; but often Southland electronics plants will off-load more labor-intensive volume assembly to majority-owned sister plants just inside the Mexican border.

And there ends the good news. Electronics executives have plenty of gripes about the Southland: its appallingly congested airports and freeways, and its smog.

More ominous is the claim of several that the region suffers from inexperienced management, particularly in marketing and finance. "I believe there's more management experience in the Bay Area. That's one of the things holding back Southern California; if there were more managers, we could move forward faster. We have more technology opportunities than managers to run with them," says Calay's Peter Shaw. □

VENTURE CAPITAL

Banking on Southern California

Images of bejeweled Beverly Hills glitterati hardly foster the impression that Southern California was ever stuck for cash. But for years, the area's entrepreneurs got short shrift as venture capitalists acted as the sugar daddies of Silicon Valley and Massachusett's Route 128.

Not any more. Southern California is coming into its own as venture funds flow in and venture firms set up shop. And there is no sign of the influx slowing. "We're still seeing an awful lot of investment activity coming in," reports Jonathan Funk, general partner with InterVen Partners in Los Angeles.

Although Southern California still lags in total capital under management — about $1 billion against $5 billion-plus in the San Francisco Bay Area and more than $2.6 billion in Massachusetts, according to *Venture Capital Journal* — it had, by late 1985, absorbed as much funding that year as Route 128 and was gaining rapidly on its northern rival.

From the end of 1983 to March 1986, venture funds under management in Southern California grew 46% to $950 million. More than a dozen venture firms had formed there; another eight had opened branch offices along "The MacArthur Corridor" — the name being applied to the financial community springing up along MacArthur Boulevard, which is next to Orange County Airport. Researchers report that at least another two offices have opened since early 1986.

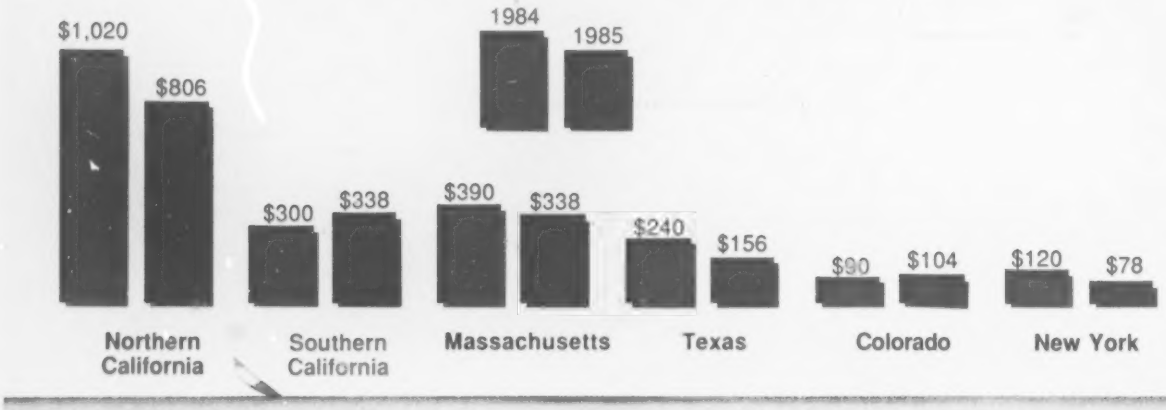
The Southland was never completely devoid of venture dollars: local money magnates like Brentwood Associates of Los Angeles had been there since 1972. Local electronics firms received some attention from Bay Area venture folks: a decade ago, printer maker Printronix Inc. of Irvine and disk-drive pioneer Tandon Corp. of Chatsworth got funding from San Francisco-based Burr, Egan, Deleage & Co.

But, generally, the region was overlooked as a second-tier market. "It's not that people were frightened of this area; more that it was perceived as the lowest priority," explains Burr, Egan, Deleage cofounder Jean Deleage.

The savvy venture firms saw dollar

Southern California gives Silicon Valley and Route 128 a run for their money

New funds invested in companies ($ millions)



Source: *Venture Capital Journal*

Marty Braun

signs in L.A. and environs precisely because it had been passed over by the crowd. "We came here because it was under-covered. There's more action up north [in Silicon Valley], but there's also more competition," explains Lawrence Lepard, a vice president of Summit Ventures, which opened a Newport Beach office in 1986.

Northern California's semiconductor slump helped accelerate the venture rush south. In the past four years, major players like Crosspoint Venture Partners and Investors In Industry have come in; in 1986, others like DSV Partners and Burr, Egan have set up local branches. DSV, with perhaps 20% of its investments in Southern California, expects its Orange County office to rival the Princeton, N.J., headquarters in strength inside two years.

Homegrown firms have opened up, too: Southern California Ventures and Julian, Cole & Stein are two such companies. Among the opportunities being targeted are medical electronics and defense.

Solid banking support is also crucial to the area's development. New York City and San Francisco were once considered America's banking hubs, but Los Angeles almost doubled its total commercial bank deposits from mid-1980 to mid-1986. With $93 billion in the vaults, L.A. trails only New York in commercial deposits, according to the Federal Deposit Insurance Corp.

Equally important to local electronics exporters is the way that Los Angeles-based banking barons like Security Pacific Corp. and First Interstate Corp. are boosting foreign-currency transactions as Pacific Rim trade grows. The region is acquiring quite a global-financing flavor: five of the 12 major Japanese banks in the United States have chosen L.A. as their corporate center. □

ORANGE COUNTY

The Orange County express

If East Coast palefaces think of Southern California high-tech at all, they usually think of Los Angeles, or at best, the San Fernando Valley to the north that is home to disk-drive firms like Tandon Corp. and Micropolis Corp.

But lately, they have been hearing more of cities like Tustin and Irvine as the electronics epicenter shifts to Orange County 40 miles south of L.A. Many may even have attended expositions at the Anaheim Convention Center next to Disneyland.

L.A.'s former bedroom community is proving anything but Mickey Mouse in industrial terms: It is fast becoming an industrial powerhouse in its own right. If the region were a separate nation, say local economists, it would rank as having the 32nd largest gross national product worldwide.

Indeed, the county is as much the polar opposite of the Rust Belt as it is possible to be. A survey of local executives conducted by University of California, Irvine, reveals irrepressible optimism: 79% predict better business for this year. The county's employment is projected to increase 5% this year, outstripping national job growth rates 2:1 and pinning unemployment to nearly 4%.

In high-tech, too, the county is putting on the ritz: Of its 50 publicly traded corporations, 15 are electronics firms with a combined stock valuation of over $1 billion. Where there once were lima-bean fields, there are now 793 electronics businesses, up from 552 in 1984.

The first invasion of the orange groves occurred in the mid-1950s as open space, cheap land and excellent transport connections made them a prime recipient of spillover from L.A.'s barnstorming aerospace industry.

The aerospace firms fostered an infrastructure of suppliers that in turn provided the underpinnings for the peripherals and computer companies that were to form there in the 1960s and 1970s.

Lately, too, Japanese companies have been locating — and relocating — in Orange County, their numbers doubling from 1979 to 1984. And local land developers have been laying out the red carpet to pull in yet more high-tech: the Irvine Co. is bulldozing 2,200 acres of agricultural land to build its showcase "Spectrum" technology park.

However, paradise is looking a little less perfect these days. A high cost of living makes for high manufacturing costs, from 5% to 20% higher than other U.S. regions, says local economist James Doti. So its electronics firms make predominantly low-volume products with high-engineering content. "It's certainly not the world's best place for manufacturing," says Fred Cox, a veteran Orange County entrepreneur and chairman of peripherals company Emulex Corp.

And in a sure sign that Orange County has come of age, electronics executives are beginning to resent a growth by-product that big-city East Coasters are all too familiar with: urban congestion. "Our airport is a disaster," grumbles one executive. □

PACIFIC RIM

The sixty-mile miracle

"The Mediterranean is the ocean of the past; the Atlantic is the ocean of the present; the Pacific is the ocean of the future."

A very contemporary theme, to be sure. But the words are those of John Hay, America's secretary of state in 1900, and his "future" lay decades away. Not until 1979 did U.S. transpacific business edge ahead of its trade across the Atlantic.

Nevertheless, bright-faced politicos are eager to push home the message that Pacific Rim trade has indeed arrived. Nowhere more so than in California, self-styled gateway to the Pacific region and the state whose electronics firms are most attuned to the transpacific possibilities.

Los Angeles gets plenty of local votes as the California region best suited to benefit. In "The Sixty-Mile Circle," a study on the economy of the area within 60 miles of its L.A. base, Security Pacific Corp. bank insists that L.A.'s the place: "In the Pacific Rim, two great urban economies stand out: the greater Los Angeles area and the greater Tokyo area. These are the leading producers of goods and services, and the leading markets. The

Pacific Basin countries are largely underdeveloped — an area with vast potential for the future. The Los Angeles area is in a very favorable position to participate in such growth."

And growth there is, say the pundits. By 1984, America's Pacific Rim trade had moved comfortably ahead of that with Europe. Researchers claim that world trade by the United States has grown from 4% of gross national product earlier this century to 17% today, and could reach 25% by the year 2000, equal to Japan's present position.

California's Department of Commerce estimates Pacific Rim trade — all imports plus exports — at over $3 trillion worth, growing at $3 billion weekly. California's portion of that came to $75 billion in 1985: $52 billion in imports, or nearly 85% of all of California's imports; and $23 billion in exports, or three-quarters of all exports (not all of these were for California-based operations, however). Japan is California's largest trading partner by far.

The increasing frenzy of Pacific freight is mirrored in predictions about the semiconductor industry. Market research firm Dataquest Inc. claims that aggregate semiconductor consumption in five key Asian markets will double by 1990, to $4 billion worth. □

SO CAL HISTORY

The Southland timeline

Where did Southern California's electronics industry come from? The answer, trite but true, is: Sunshine.

Almost every branch of the local electronics family tree is rooted in the aerospace industry which, like Hollywood's movie business, came to the L.A. basin because the weather permitted year-round production. At no time was this more critical than during World War II.

Here are a few milestones in the development of the Southland's electronics sector:

• **1938:** Howard Hughes' record-breaking around the world flight confirms viability of constant radio communications between aircraft and ground stations, paves way for Hughes Aircraft Co.'s metamorphosis into defense-electronics company;

• **1942:** Arnold Beckman's new Helipot potentiometer sought by the military for use on the then-new radar; forms basis of Beckman's components business;

• **1946:** Marlan Bourns founds components maker Bourns Inc., devising for aerospace industry a linear-motion potentiometer that accurately measures minute changes in position of aircraft flight control surfaces in wind tunnel tests.

• **1947:** Hughes Aircraft Co.'s radio department becomes electronics department. Specializes in radar and guided-missile technology.

• **1950s:** Aerospace industry's supply base matures: test shops, design services and circuit-board makers grow to serve new electronics entrants.

• **1954:** Howard Hughes' thorny personality causes top Hughes staffers Simon Ramo and Dean Wooldridge to leave, form a company that was later to become TRW Inc. C.B. Thornton also departs, founds Litton Industries Inc.

• **1960s:** Orange County: Varian Data Machines, founded by ex-aerospace engineers, builds one of first minicomputers. Varian, in turn, spawns other computer companies: Computer Automation Inc., General Automation Inc. and others.

• **1973:** Computer Automation unveils Naked Mini/LSI, a low-cost minicomputer using large-scale integration.

• **1970s:** Medical electronics industry begins to grow in L.A. basin. Many firms owe origins to Beckman Instruments and Edwards Laboratories.

• **1970s:** Peripherals companies settle in Southland: Tandon Corp., Printronix Inc.

• **1980s:** Venture capital begins to flow into region.

• **1980s:** Rockwell International Corp.'s semiconductor research center northwest of L.A. is nucleus for several spin-offs making gallium arsenide chips in "Gallium Gulch." GigaBit Logic Inc. is the most famous.

• **1980s:** Japanese electronics companies now firmly entrenched in Southland. □

IVORY TOWERS

The academic brain trust

Eight years ago, a programmer at the Jet Propulsion Laboratory (JPL) in Pasadena, Calif., figured he was onto a good thing. He had devised some clever software that was perfect for running the office's football betting pool.

Few guessed how much of a good thing this program was. "Discovered" by entrepreneur George Tate, it surfaced as one of the best-known labels in desktop software: dBASE II.

The creation of Ashton-Tate's popular database package hints at the technology potential hidden inside JPL — technology that could electrify Los Angeles's high-tech base. "Just having something like JPL is of major benefit to the electronics industry in Southern California," says Intel Corp. chairman Gordon Moore.

And it raises conjecture over why the Southland's other ivory towers, the universities, have not done for local electronics firms what Bay Area academia did to fire up Silicon Valley. "We need to get more out of our universities," insists Peter Shaw, president of Irvine-based workstation maker Calay Systems Inc.

dBASE II aside, JPL's technology riches largely remained there because the NASA center had poor contacts with local industry.

For their part, the universities, until recently, lacked the breadth of technological expertise that comes from research freedom and massive funding, and which their northern counterparts, Berkeley and Stanford, enjoyed.

Not that the Southland is short of

gray matter. Here are the jewels in the University of California crown: UCLA, UC San Diego, and UC Irvine. The area also has the prestigious California Institute of Technology (Caltech), where computer-science professor Carver Mead, now researching neural-network computers, is credited with shaping the integrated-circuit design ideas of a generation of young engineers through his textbooks.

Caltech's alumni roster is formidable: it includes Intel's Gordon Moore, venture capitalist Benjamin Rosen; instrumentation doyen Arnold Beckman; and TRW Inc. founders Simon Ramo and Dean Wooldridge.

But what Southland academia lacked in available core technology, they have more than made up for in other ways. L.A. industrialists pour praise on the ability of their universities to crank out capable engineering graduates.

Interstate Electronics Corp. can testify to that: the defense contractor used to recruit engineers nationwide, but now, says president Richard Foster, he gets the talent he needs locally. Over half the recruiters that visit Caltech are from California corporations.

L.A. industrialists pour praise on the ability of their universities to crank out capable engineering graduates

The local schools also provide business-school backing. Pepperdine University and UCLA's graduate school of business offer middle management the training to climb the corporate ladder.

Regarding the universities' technology lag: Calay's Shaw will be heartened to learn that Southland campuses are less wet behind the ears these days. UCI now wins plaudits for its computer-science school. And they are actively trying to transfer their technology to industry. At UC Santa Barbara, a $14 million semiconductor-manufacturing program is assisting local defense contractor Delco Systems Operations and others, while a smaller effort on exotic semiconductor compounds is receiving Semiconductor Research Corp. funds.

To the south, UC Irvine's corporate university partners program is beginning to draw industry attention in medical electronics. CalTech has a technology-transfer scheme that allows industry-consortium members to steer and benefit from research into solid-state physics and other fundamental sciences.

And JPL has finally found a middleman. Last year, the RIMTech networking group launched a technology-transfer program that promises to sell Southland electronics participants JPL's skills in everything from error-correcting codes to advanced graphics. □

DEFENSE

A defensive reliance

Los Angelenos who still thrill to The Beach Boys remember the post-Vietnam slowdown in the aerospace industry that laid off many local engineers. No one wants it to happen again.

However, the signs are that Southern California is still substantially dependent on the fortunes of the defense sector. Just how dependent is hard to tell: California's Department of Commerce says that over half a million residents work in defense in the six coastal counties from Santa Barbara south to San Diego. The "Top 400," a guide to Orange County's electronics companies, indicates that a third of that county's employment is in aerospace and defense.

"We certainly are more vulnerable to a defense downturn than the Bay Area or Route 128. I'd bet that well over half [of the Southland's electronics] employees are aerospace and defense oriented," says Richard Foster, president of Anaheim contractor Interstate Electronics Corp.

But others believe Southern California's economy is more immune to defense cutbacks than in 1971, largely because of the dramatic buildup in other electronics sectors.

Electronics distributors that supply military contractors are unequivocal. "The strength of the market here has been and continues to be defense," says Ralph Ozorkiewicz, president of Wyle Laboratories' Electronics Marketing Group. He estimates that about 30% of Southern California's total available market is in military work.

That work ranges from Rockwell International Corp.'s production of the B-1B bomber to the infrared missile-guidance systems built by Ford Aerospace & Communications Corp.

Southern California's economy is more immune to defense cutbacks than in 1971, largely because of the dramatic buildup in other electronics sectors

Marty Braun

and used in last year's U.S. raid on Libya; from classified research on Stealth technology at Northrop Corp. to development of blue-green lasers and gallium-arsenide chips at Hughes Aircraft Co.

The region has landed some plum programs: the $65 billion development of the Advanced Technology Fighter (ATF), now being competed for between prime contractors Northrop and Lockheed Corp. The *Los Angeles Times* claims that as many as half of the subcontractors, which should receive up to 75% of ATF revenue, are in Southern California.

However, a distinct industry downturn is already under way. Market research firm Henderson Ventures of Los Altos, Calif., puts a 3.6% growth rate on military electronics production in 1988; most believe zero real growth is more like it. Major contractors like Hughes have put workforce reductions in place — a 5% cut from its 80,000 level. Fortunately for the Southland, it has not yet felt the squeeze.

Several local electronics executives point to substantial benefits either way. "When aerospace softens, it loosens up the labor pool," explains Peter Shaw, president of Calay Systems Inc., an Irvine-based producer of work-

stations for circuit-board design. If the downturn becomes serious, L.A.'s electronics employers can get choosy: aerospace firms hire and fire in the thousands.

They may be well worth hiring, but do these engineers have what it takes to start their own companies? Unlikely, say most observers: Aerospace types may design superlative microwidgets, but they typically lack the right stuff: the entrepreneurial thrust and management talent that fuel high-tech start-ups. "It's not the kind of industry that lends itself to start-ups," says one venture capitalist.

Nevertheless, some of his fellows are intent on finding the exceptions that prove the rule. James Julian, a partner with Julian, Cole & Stein in L.A., aims to tap the aerospace industry and back engineering brilliance with street-smart management. "Aerospace is one of the last bastions of great technology," he maintains. □

JAPANESE PRESENCE

The Japanese connection

Heading east from Los Angeles International airport on Route 91, a visitor could be forgiven for thinking he had missed L.A. altogether and landed in Tokyo. A profusion of Nippon names is the roadside greeting thereabouts.

A concentration of Japanese industrials is not peculiar to Southern California, but the density of that agglomeration and the speed with which it has grown are unusual. The Japan Business Association of Southern California has 550 corporate members, 65 of them electronics and electrical; in 1962, it had 58 members, none of which were in electronics.

California's technology reputation and its large business and consumer markets have long made the Golden State a favorite for Japan's industrial investors. The Pacific time zone is handy too: a late-afternoon phone call catches the Land of the Rising Sun not long after the sun has risen.

No surprise, then, that Japan is the largest foreign employer in California and that the state accounts for 25% of the value of Japanese property in the United States. California's Department of Commerce calculates that the value of property, plants and equipment owned by Japanese companies in California climbed sevenfold from 1977 to $3.8 billion in 1984, with about one-sixth of that in electrical and electronics machinery.

The Japanese show a marked preference for the state's southern half. In 1985, they made 54 investments in the greater L.A. area against 34 in the Bay Area. Reports indicate that 800 of the state's 1,000 Japanese companies are in the south, and that of the 12 major Japanese banks in the United States, five are based in Los Angeles.

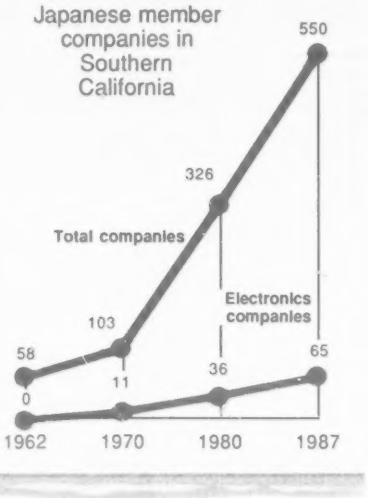
The phenomenon owes just as much to cultural links and L.A.'s acceptance of ethnic diversity as to its Pacific proximity. "L.A. was certainly the city where the first Japanese immigrants came," says Takeshi Sakurai, president of Mitsubishi Electronics America Inc.

Those immigrants arrived over a century ago, helping build the transcontinental railroad and later moving into farming and produce marketing. Around a "Little Tokyo" in downtown Los Angeles, they set up schools, restaurants and other cultural anchors that have since proved a draw for incoming Japanese industrialists. Torrance-based Seiko Instruments USA Inc. president Hiroshi Fukino is pleased that his daughters can attend Saturday school nearby.

Within the L.A. basin, many of the Japanese electronics concerns settled initially in Torrance and Compton, near Los Angeles International airport, Long Beach harbor and the Japanese banks. But lately there has been a shift south into Orange County, a trend Mitsubishi's Sakurai says he attributes to the wealth of "good engineers" in the area.

The Japanese have also put down manufacturing roots, more often to ease dollar-yen fluctuations than for betterment of trade relations. Mitsubishi recently escaped trade tariffs on its personal computers because it assembles in Torrance. Hitachi Ltd. builds the only American-made video cassette recorders in Anaheim. □

The Japanese presence is expanding fast in Southern California



Source: Japan Business Association of Southern California

MEXICO

South of Southland's border

Southern California has an electronics ace that only Texas can match: its proximity to Mexico. More than a few Los Angeles-based electronics companies owe their financial health to the nearness of the border.

Local electronics employers do not benefit from the influx of day workers from Mexico to "El Norte," nor from the base of immigrant labor in the Southland. Their edge comes instead from the *maquiladoras* — subsidiaries they own south of the border.

The so-called maquilas import parts from the U.S. duty free and "export" assembled units back to the States with 10% average value-added tax, giving U.S. firms the blessings of offshore manufacturing with fewer of the drawbacks.

As a rule, Southern California's electronics companies have benefited more than any others from these Mexican subsidiaries. "You don't have a lot of representation from Silicon Valley," says John Sartori, president of Sarco International, a Newport Beach-based consultancy specializing in border manufacturing services.

"There are clearly more Southern California firms that have more knowledge of maquilas, and with more knowledge comes more involvement," adds Gordon Reed, a vice president of Santa Ana, Calif., manu-

Murry Braun

facturing engineering consultancy North & Donahoe.

Sartori says that of the 1,100 maquilas along the border nearly 40% are in Baja California, California's Mexican neighbor. Of these, up to 60% are affiliated with Southern California concerns, with a strong bias toward electronics assembly.

Among the L.A.-basin electronics companies with large maquilas are: Hughes Aircraft Co., passive components maker Bourns Inc., power semiconductor producer International Rectifier Corp. (IR), disk-drive builder Shugart Corp. and Rockwell International Corp.'s Semiconductor Products Division (SPD).

Rockwell's Newport Beach, California-based SPD has plenty of praise for the yields, costs and cycle times of the Mexican sister plant it first opened in 1969 and which it upgraded last year into a full metal-oxide semiconductor assembly and testing plant. Admits Gerry Gross, director of device manufacturing: "Had we not done that, we would not have been competitive. We would have lost money."

Mexican plants offer freedom from the product piracy that plagues Far Eastern facilities

IR has had an assembly maquila for its high-power Schottky diodes for a decade. "We have been profitable during the five to eight years that others were not. To a fairly high degree that is due to our Tijuana plant," says Anders Nilarp, worldwide vice president for high-power operations.

And Information Magnetics Corp., the division of CCT Corp. that makes magnetic heads for fixed disk drives, moved its headquarters to San Diego to be closer to the maquila it credits with countering Far East competition.

Low labor costs are an obvious plus for the maquilas: Sarco International prices their average electronics assembly labor at less than $1 per hour with all fringes. Overall return on assets is high: IR's Nilarp maintains that a similar plant located in the Far East would have to carry up to three times the parts inventory. Other gains include energy costs that are nearly a quarter of those north of the border, and less stifling factory regulations.

Consultant Gordon Reed adds that Mexican plants offer freedom from the product piracy that plagues Far Eastern facilities. And experts point to the ease with which the maquilas can be overseen from Southern California: Tijuana is a two-hour drive from Los Angeles; Mexicali and Nogales are not much further.

But these advantages have not been enough to outweigh one sharp drawback discovered by printer maker Printronix Inc. of Irvine. Hurt by the difficulty of sourcing components for its Mexicali facility and by the dearth of electronics professionals locally, Printronix recently shut the plant down and moved instead to Singapore. □

MEDICAL ELECTRONICS

Med-Tech in the sun

Pinning an industrial identity on Southern California is like trying to nail jello to the ceiling. Unlike the San Francisco Bay Area's synonymity with semiconductors, L.A.'s eclectic electronics mix does not make for easy labeling.

But there is one sector that is starting to call the region home: medical electronics. With Orange County as its hub, a mini-industry, making products from heart pacemaker chips to controllers for intravenous fluid delivery, is laying claim to the third-ranked spot for production of medical-electronics equipment in the United States. It has even earned itself a nickname: "Med-Tech."

According to Tustin, California-based journal *Biomedical Business International*, Southern California's microchip medicos number about 60, up 50% in five years. Their aggregrate revenue tops $500 million annually; New England leads, with up to $800 million, with Minneapolis — a center of pacemaker production — in second place.

Med-Tech, whose specialties include diagnostic imaging, clinical chemistry and patient monitoring, is growing somewhat faster than the 5% real growth seen by the sector as a whole. Cardiovascular Devices Inc., an Irvine manufacturer of blood-gas monitors for open-heart surgery, expects over 25% annual pick up.

But the Orange County region, say proponents, is set for greater things because it is moving swiftly into new technologies. There is promise for analog-to-digital chip technology, which is enabling custom-chip suppliers like Holt Integrated Circuits Inc. of Irvine to shed reliance on pacemaker chip sales and enter instrumentation markets with new products like its single-chip pH meter.

The Orange County region, say proponents, is set for greater things because it is moving swiftly into new technologies

Marty Braun

Similarly, Tustin-based Silicon Systems Inc., a maker of chips for modems and disk-drive controllers, is close to a program to develop biosensor chips whose analog function will "read' biological conditions and transmit them to the digital portion of the same sliver of silicon for data processing.

The Southland's medical-electronics skills were honed in unwitting nuclei like Beckman Instruments Inc. and Edwards Laboratories, and grew without much early support from local schools. But now, campuses like University of California, San Diego and University of California, Irvine (UCI) promise strong back-up. UCI's 3-year-old corporate partners program is starting to push medical technology out of its labs and into local industry.

Silicon Systems has signed up; Holt is keen to. "Industry wants to use us as a think tank," explains Daniel Morris, manager of UCI's partnership scheme. UCI's laboratories have already been useful to Irvine-based Trimedyne Inc., a $10 million company making a laser device for clearing clogged arteries. □

CFOs remain cautious about the economy

An exclusive ELECTRONIC BUSINESS poll of 127 chief financial officers suggests modest growth in the second half

By Bruce C.P. Rayner and Nancy McSharry

The electronics industry will undergo modest growth for the remainder of the year, according to the ELECTRONIC BUSINESS midyear survey of chief financial officers and vice presidents for finance. One of the biggest concerns is the growing uncertainty surrounding the trade friction with Japan.

But first the good news. For the second half of 1987, CFOs expect growth rates in segments of the electronics industry to range from 8.6% in passive components to a healthy 18% for semiconductor makers. Putting these figures in context, Data Resources Inc. (DRI), a leading economic forecasting firm based in Lexington, Mass., expects U.S. GNP growth of a meager 3% annual rate for the second half of the year.

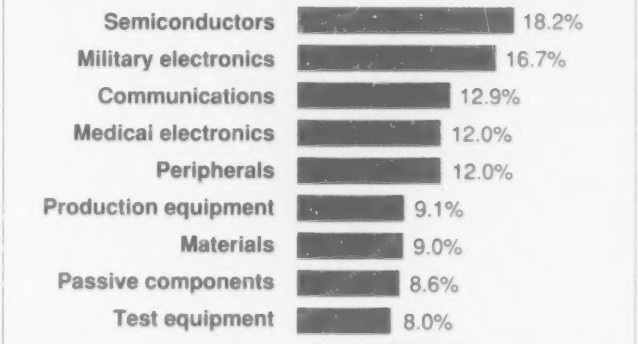
Another bright spot gleaned from the survey is that 60% of the respondents expect their factory utilization to increase during the next two quarters. This is partly due to short-term market improvements combined with a glimmer of hope for U.S. export growth, especially in Europe. Over 50% of respondents expect the European computer and electronics market to expand as the weaker dollar begins to generate demand. Also, over 40% of those surveyed indicated that they will increase their rate of capital and R&D investment in the second half of 1987, compared with the same period in 1986.

The ELECTRONIC BUSINESS survey results are based on a comprehensive questionnaire mailed to 700 financial officers in the U.S. electronics industry. In all, 127 completed questionnaires were returned, representing an 18% response rate. Over 51% of the companies polled had revenue of less than $20 million for 1986. We believe the survey is 97% accurate, with a margin of error of plus or minus 3%.

Nevertheless, expected growth rates in factory utilization and capital expenditure forecast by our respondents may be misleading. Both figures were low last year, so increases do not necessarily mean substantial economic improvements. For instance, capital spending in the first quarter of 1987 was uncharacteristically low partly because of tax reform: specifically, changes in depreciation methods and the repeal of the investment tax credit. So, even though the rate of capital spending is improving, it is still far from robust. David Wyss, senior vice president at DRI, forecasts that equipment investment will grow at a rate of 5.5% to 6% for the remainder of the year.

GROWTH BY SEGMENT

Based on internal data and data supplied from outside sources, how much will the industry segments in which your company participates grow during 1987?



Source: ELECTRONIC BUSINESS

For the second half of 1987, 50.7% of the respondents expect the European computer and electronics market to expand. Also, 47.6% characterize the military equipment market as "good" and 45.3% expect military spending on electronics to rise over the next two years. But prices are on the up and up: 66.9% believe U.S. labor costs will rise over the next two years; 82.3% see inflation rising over the next six months; and 66.9% expect the price of precious metals to rise in the second half of the year.

Underlying issues

Most of the news from chief financial officers is of a more somber tone. There are some underlying economic issues that are stifling true recovery, many financial officers believe. The list of complaints is lengthy: inflation and interest rates are on the rise, the dollar is weak and possibly weakening further (a mixed blessing), the national debt grows daily and trade friction has everyone on edge. "Taken in the aggregate," says Timothy Carlson, vice president for finance of Laserpath Inc., a $3 million gate array semiconductor manufacturer in Sunnyvale, Calif., "that's a pic-

ture that is of some concern." Carlson expects some economic hiccups before the year is out. Others agree with his prognosis.

Most economists agree that a weak dollar is beginning to reverse the U.S. trade deficit. But because many Far Eastern countries tie their currencies to the U.S. dollar — these include South Korea, Singapore and Taiwan — the effect on imports is not consistent. It is mainly the Japanese yen and European currencies that have continued to rise against the dollar. Some believe the current yen exchange rate — around 140 yen to the dollar — could still drop 15% before it bottoms out. Wyss estimates the dollar's value will reach a low of ¥120, but probably not until next year.

Still, in the last quarter of 1986 and the first quarter of 1987, the volume of U.S. imports declined, while exports grew at a 14% rate for the second half of 1986, says Wyss. He predicts that U.S. exports will grow in the second half of 1987 but not quite as rapidly. Despite the fact that import prices continue to rise, he says there is a clear trend toward the United States buying fewer foreign goods, especially Japanese products. The reason — says John Rogers, vice president for finance and company treasurer at Zytec Corp., a $50 million power supply maker in Eden Prairie, Minn. — is that the price advantage that Japan has had over the United States is eroding. In the past year, it has dropped from around a 15% differential to only 5%, Rogers says.

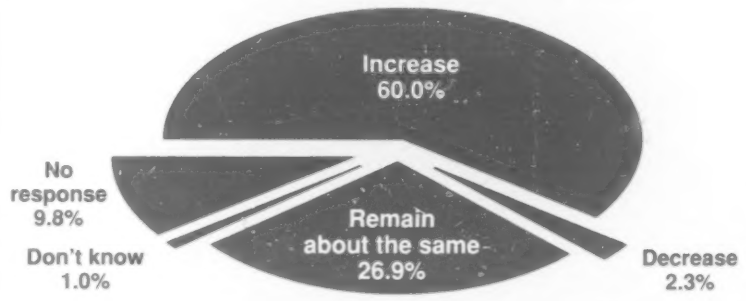
Robert Golden, vice president for finance at Cleveland-based Mueller Electric Co., a $5 million supplier of electrical test clips and test leads, agrees that the falling dollar is starting to take hold. He says that his domestic customers are beginning to increase their exports, while Mueller is seeing a pickup in its Canadian and European orders.

Rising prices

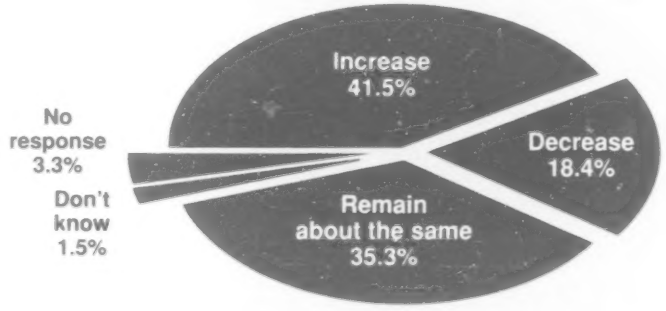
At the same time, there are negative consequences of a weak dollar that must be considered. The most notable side effect is the increasing price of foreign components that U.S. electronics manufacturers are forced to pay. Gene Ruckh, chief financial officer of Computer Communications Inc. (CCI), a $10 million Torrance, California-based maker of transactional processing systems, says that costs of Japanese commodity chips are rising and availability could become an issue. CCI gets about 20% of

PRODUCTION AND INVESTMENT

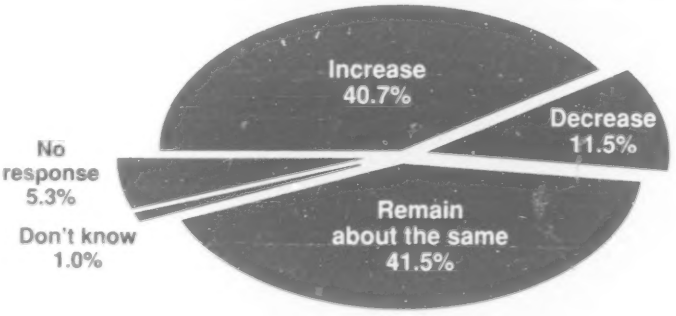
In the second half of 1987, will factory utilization for your company:



In comparing the second half of 1987 with the same period of 1986, do you expect your company's rate of capital investment to:



In comparing the second half of 1987 with the year-earlier period, do you expect your company's rate of R&D investment to:



Source: ELECTRONIC BUSINESS

Only 29.9% of those respondents expect to add manufacturing capacity and only 34.6% will find it necessary to raise capital in the second half of 1987. Part of the reason for holding off on adding factory space may have to do with the expectation of increasing interest rates: 74.6% expect interest rates to rise. More likely, however, it has to do with the low level of plant utilization during 1986 and the first half of 1987. Similarly, capital expenditure, in the form of purchases of equipment, has been very depressed for the last year largely as a result of conditions in the industry but also because of tax reform.

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its materials from offshore. Ruckh speculates that Japan will begin to shift production offshore to a second-country surrogate, such as South Korea, in order to keep prices under control and hold onto its U.S. market share.

But more threatening to American companies than rising prices of materials is the fact that U.S. companies are now considered good value in the eyes of foreigners who are looking for acquisitions in the United States. Over 28% of those surveyed say that they expect foreign corporations to increase the rate of acquisition of U.S. firms, while 35% indicated the rate would remain about the same.

Direct investment in U.S. companies by the Japanese is also a way of deflecting protectionist measures that Congress might impose in the near future. Joint ventures, start-ups and buyouts are all options that Japanese companies are looking at. Also, there has been a noticeable shift by the Japanese from the bond market into the stock market since last year, says DRI's Wyss.

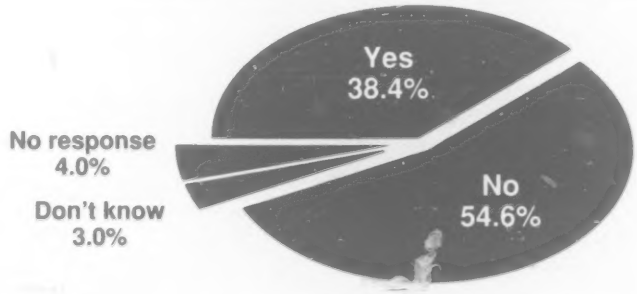
But of more immediate concern are the battle cries emanating from the halls of Congress these past few months. Although many chief financial officers believe that trade sanctions may solve some short-term problems, most indicate that long-term issues of productivity and competitiveness deserve primary attention. However, over 67% of those surveyed expect trade friction between the United States and Japan to increase in the second half of 1987. Also, 62.3% expect the United States to increase tariff barriers on Asian electronics in the next six months. America's newfound protectionist fever has many in the electronics industry worried about the stability of the international marketplace.

The question everyone is asking is: What will happen if Japan retaliates in kind to import restrictions? As Wyss points out, the least harmful response would be if Japan simply mirrors U.S. legislation. That is, if Japan put equal limitations on imports from the United States. But that is the least of America's worries: Japan has more damaging options up its sleeve. It could shut its borders down all together and it could withdraw its financial resources from American markets. Simply put, Japan could wreak havoc on the U.S. economy. □

> Over 28% of those surveyed say they expect foreign corporations to increase the rate of acquisition of U.S. firms

INVENTORIES

In the second half of 1987, do you anticipate that your company will build inventory in materials, componentry and/or systems?



Source: ELECTRONIC BUSINESS

With the prices of foreign components increasing, 62.3% of respondents expect tariff barriers on Asian electronics exports to the United States to increase, making them even more expensive and limiting their availability. Similarly, 36.9% expect more U.S. companies to move offshore and 67.6% expect trade friction between the United States and Japan to increase. Also, 28.4% expect the rate of acquisition of U.S. electronics companies by Japanese and European corporations to increase.

BY BETH KARLIN

Trade issues dominate second-half outlook

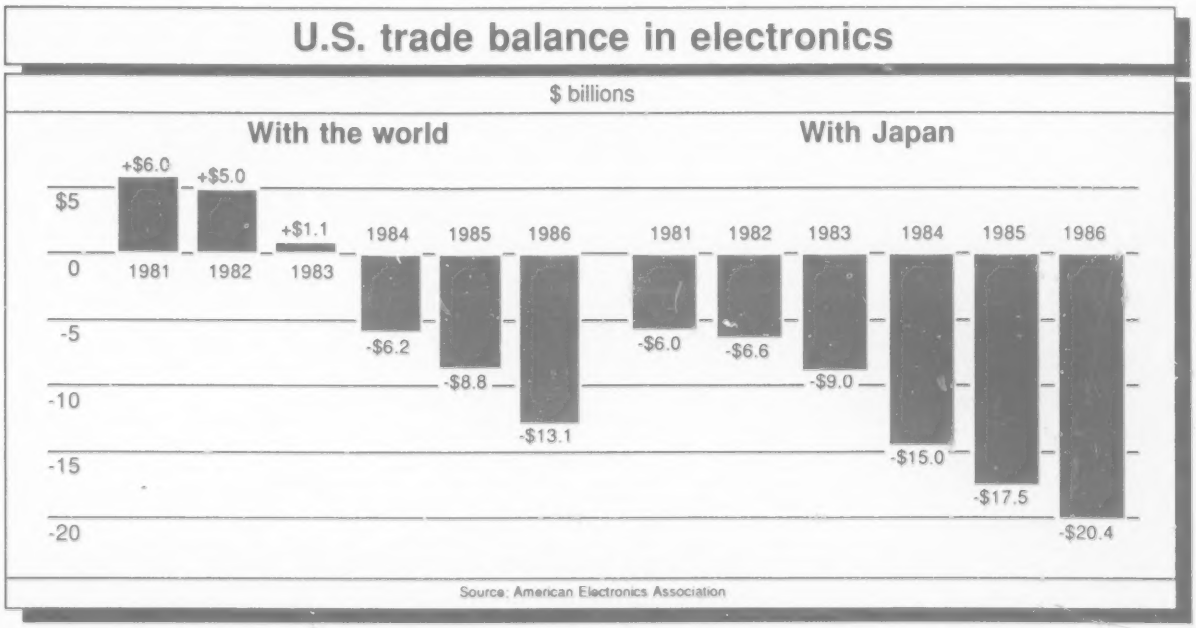
Thanks, in part, to the decline of the dollar, the industry, overall, can look forward to continuing expansion

It was all sunshine and blue skies when President Reagan welcomed Japanese Prime Minister Yasuhiro Nakasone to the White House for trade talks in late April. But the fair weather outside belied the dark clouds inside the Capitol where legislators were debating just how tough to get with Japan in the sweeping trade legislation being considered in Congress. Trade clearly is the key issue in Washington this year. The trade deficit reached a record $170 billion last year and with the buzzwords "economic competitiveness" on everyone's mind these days, Congress is intent on doing all it can to reduce that imbalance.

While Congress haggles over the trade bill, export control legislation and the budget this year, U.S. exports are beginning to pick up on their own — with electronic components and computers leading the way. Indeed, the long-awaited recovery from the electronics industries' deep recession of the past few years appears to be under way.

"Based on first quarter preliminary statistics, we're very pleased," says Mark Rosenker, vice president, Electronic Industries Association. U.S. factory shipments of electronic equipment, components and related products totaled $56.8 billion in the first three months of the year, up about 7% from the first quarter of last year. EIA is projecting that total industry shipments will be between $220 billion and $225 billion this year, up from about $212 billion in 1986.

Thanks largely to the declining value of the dollar on world markets, nonautomotive capital goods exports will rise about 14.5% in constant dollars this year, compared with a 9.5% rise in 1986, according to Data Resources Inc., a unit of McGraw Hill Co. In current dollars, capital goods exports are expected to climb to $88 billion, from $78.2 billion last year, DRI says. "We're definitely seeing im-



provements in competitiveness of capital goods exports. And we expect that to continue,' says John Jelacic, senior international economist in the Commerce Department's Office of Trade and Investment Analysis.

The U.S. electronics trade deficit with the world market, meanwhile, appears to worsen. While at press time, no one is forecasting the 1987 electronics deficit, it appears unlikely to improve this year. The U.S. electronics deficit with the world market has been getting worse each year since 1983, the last year in which there was a positive trade balance of $1.1 billion, according to the American Electronics Association. In 1986 the deficit climbed to $13.1 billion, from $8.8 billion in 1985. Meanwhile, the U.S. electronics trade deficit with Japan last year climbed to $20.4 billion, from $17.5 in 1985, according to the AEA.

With the fall of the dollar, the cost of some foreign goods are becoming prohibitively expensive here, at the same time U.S. exports are becoming increasingly appealing to foreign buyers. "Those industries, such as computers and equipment, that compete on world markets can take advantage of the decline of the dollar," says Sara Johnson, a DRI senior economist. "Also at an advantage are those segments that have been hurt by import penetration, like semiconductors."

Semiconductor exports, for example, are expected to increase 25% this year, according to the Commerce Department, which projects an 11% rise in total U.S. shipments for the year. In March, meanwhile, the Semiconductor Industry Association, reported that all three key indicators of U.S. semiconductor market business conditions increased, reaching the highest levels experienced by world semiconductor manufacturers since 1984. Average monthly orders for the three months ended in March rose 15.6% to $910.8 million, up from $788.2 in February.

Shipments for March totaled $912.1 million, up 34.6% from February's $677.8 million. And three-month average billings for March totaled $751.3 million, a 6.5% increase from the same figure for February. In March, the book-to-bill ratio for U.S.-, Europe- and Japan-based semiconductor manufacturers doing business in the United States rose to 1.21 (meaning that for every $100 worth of product shipped, manufacturers received $121 in new orders), the sixth consecutive monthly increase.

Buyers, meanwhile, expect to increase their 1987 semiconductor purchases by 13%, according to a Dataquest Inc. survey of ELECTRONIC BUSINESS' top 200 electronics companies (excluding those electronics companies that do not buy components). Last year, a survey of the same group indicated purchases would increase only 7%; which is very nearly what happened in 1986.

Electronic equipment and components

U.S. production ($ billions)

	1986	1987	1988	1989
Communications	$70.2	$72.2	$78.1	$83.7
Computer and office	53.0	55.0	62.1	68.8
Industrial	25.1	25.9	26.7	27.8
Instruments	60.8	63.1	68.2	72.1
Radio and TV	13.2	14.2	15.0	15.9
Total equipment	**$222.2**	**$230.4**	**$250.0**	**$268.4**
Components	44.1	49.3	53.5	57.9
Total	**$266.3**	**$279.7**	**$303.6**	**$326.3**

Numbers may not add up due to rounding

Source: Analytics

Military maneuvers

Industry watchers are also projecting that 1987 will be a year of regeneration for personal computers and related industries. Infocorp, a Cupertino, Calif., market research firm, predicts unit and dollar sales will increase 22% this year worldwide and 25% in the United States.

> EIA is projecting that total industry shipments will be between $220 billion and $225 billion this year, up from about $212 billion in 1986

The jury is still out on military electronics. Growth is expected to slow over the next few years, but then rebound. U.S. production of military electronics will increase only about 4.4% this year and 3.5% in 1988, according to Henderson Ventures, a Los Altos, Calif., market research firm. "Gramm-Rudman legislation and the president's opposition to tax increases leave little room for increased defense spending," says Edward Henderson, president of Henderson Ventures.

In the defense budget, President Reagan is calling for a 2.1% drop in procurement, but a 19.1% increase in research, test, development and evaluation. The RTD&E portion is electronics intensive, and with the administration's emphasis on the Strategic Defense Initiative (SDI), electronics companies should benefit. In general, spending for command, control and intelligence (C^3I) will remain strong, with Henderson forecasting an 8% increase in production for 1987 and a 5.8% increase in 1988. But radar systems are expected to decline 1.2% this year, and then an additional 1.4% the following year, according to Henderson.

Telecommunications, meanwhile, remains soft. "There is some weakness there," says Electronic Industries Association's Rosenker. "Maybe its stiffer competition." After growing 5.8% in 1986 to $70.2 billion, U.S. communication equipment production is expected to grow only about 2.9% this year to $72.2 billion, according to Kent Webb, founder of Analytics, a Palo Alto, Calif., consulting company. Next year, Webb says, production will rise 8.2% to $78.1 billion.

According to Webb, total U.S. production of equipment will rise 3.6% to $230.4 billion, following a fall of 0.4% last year to 222.2%. In 1988, he estimates, production will increase another 8.5% to $250 billion. "Industry is still rebuilding, but by this time next

year things should be in relatively good shape."

Despite the falling dollar, many data-processing and communications companies continue to shift production offshore. In the Dataquest procurement survey, about 43.3% of the respondents said they anticipated shifting at least some production offshore. Dataquest estimates that the U.S. semiconductor consumption moving offshore will represent 11.8% of total dollars this year, compared with 9.5% of total dollars last year. While there may be some slowing of movement offshore, says Anthea Stratigos, associate director of Dataquest's Semiconductor Applications Markets service, "overall, we believe that users expect moderate growth in purchases, and that shifts in electronic equipment production offshore may have long-term implications for domestic semiconductor consumption."

Consuming issues

Some believe that the falling dollar overcompensates for what really has been lackluster growth. Worldwide semiconductor consumption measured in U.S. dollars, for example, actually grew 25.6% last year, according to San Jose, California-based Dataquest. Obviously this overstates the real growth in consumption in overseas markets. Japanese semiconductor consumption grew only 1.9% in 1986 measured in yen, according to Dataquest figures. But this translates into a 44.9% growth rate in U.S. dollars. "Although the sharp fall of the U.S. dollar against the yen dramatically overstates the Japanese consumption growth rates, 1986 was a slow year," according to a Dataquest report written by consultants Howard Bogert and Joe Borgia.

Even though much of the growth is due to the weakness of the dollar, industry watchers, nonetheless, see strengthening demand for electronics products this year and next — but at a more moderate rate than the industry had gotten used to earlier this decade. "We expect healthy but moderate growth in world semiconductor consumption in 1987, strengthening into 1988," say Bogert and Borgia. "We seem to miss the fever of the customary upswing, but the reality is a moderate and more stable growth."

Indeed, many analysts echo the optimism of Webb of Analytics. 'This year there will be more demand as well," he says. "There are definite signs that the recession is ending." □

BY ANNE KNOWLES

Computers: You can hear the sigh of relief

If first-quarter results are any indication, the computer industry is climbing out of the doldrums with a flourish

Throughout the computer industry, you can practically hear the sigh of relief. First quarter results were, with few exceptions, superb. Digital Equipment Corp. posted an 81% gain in profits on a 25% rise in sales. Apple Computer Corp. recorded a 6.6% jump in profits on a surprising 41% increase in revenue. Amdahl Corp., awing everyone including itself, posted 1,050% skyrocket in profits on an amazing 159.5% gain in sales.

Other signs were positive, too. "Some big players are encouraged by order rates," says Richard Mikita, an analyst with International Data Corp. (IDC), a market research firm in Framingham, Mass. "The bookings bode well." New orders for computers and office machinery should increase 11.4% this year, up from a 11.8% drop last year, according to Cahners Economics. Shipments should rise 5.2%, says Cahners Economics, after a 9.6% dip last year.

IDC anticipated early on that 1987 would be a turnaround year for the computer industry. Mikita expects 7.6% sales growth in the total U.S. computer market, encouraging after a 1.5% spurt in revenue last year. Mikita says users he has recently talked to plan to have "reasonably healthy buying" activity for the remainder of the year.

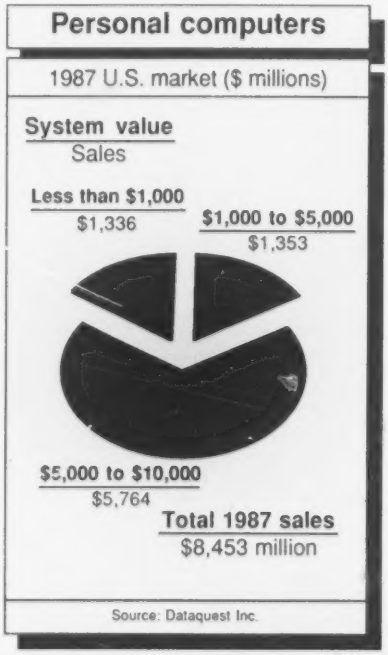
The fact that the industry is not returning to double-digit growth is not worrisome either, says Mikita. He adds that 7.6% growth is respectable. His forecast, into the beginning of the next decade, calls for growth rates in computer revenue to hover below 10%. The business, says Mikita, has entered into the company of other mature industries.

Others see a trend toward moderation also. "I don't see the same level of capital spending we may have seen two or three years ago," says Charles Fonner, director of systems marketing at Amdahl in Sunnyvale, Calif. "I don't think people are buying excess capacity as they might have before."

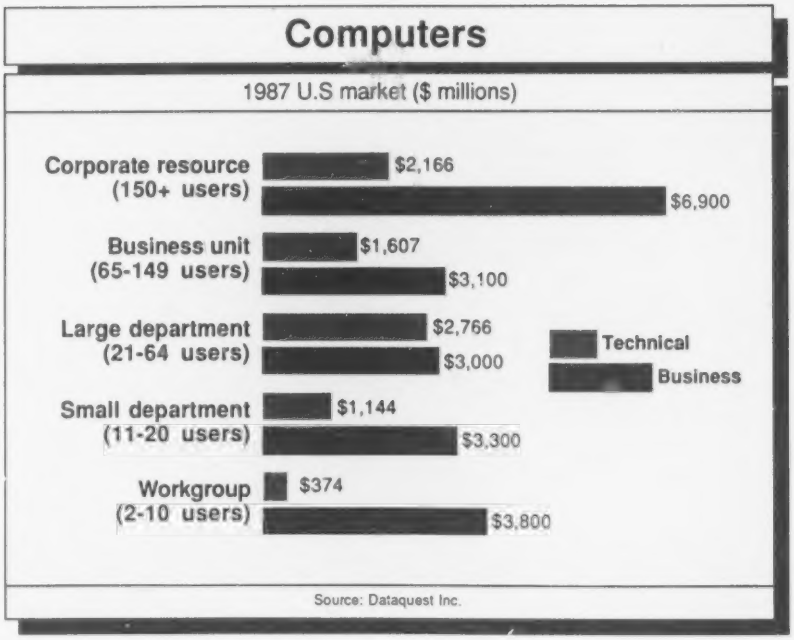
"There are smarter acquisition policies in the user community," concludes Fonner. That bodes well for computer manufacturers, he says, who can now expect a little more predictability in the marketplace. "Users are buying incrementally now," says Fonner. They are buying a little less each time, he says, but they're buying a little more often. The result for manufacturers, concludes Fonner, "will be smooth growth for the next 18 to 24 months."

Spending up

"There is clearly a lot of people buying equipment," agrees Suzanne Peterson, an analyst with First Boston Corp. in New York City. While the indicators are positive for the industry



Computers



as a whole, says Peterson, "it is not going to turn around for every company." Data General Corp., for example, was one of the exceptions during the first quarter party. The Westborough, Mass., mini maker posted its biggest loss ever in its second fiscal quarter, ended March 28. DG reported a $42.6 million loss in net income, including a $9.6 million operating loss. Total revenue for the second fiscal quarter, $315.2 million, dropped 1% from the previous year's quarter results of $318.8 million in revenue.

DG's primary problem, asserts Peterson, is a shift in the industry toward standard operating systems. DEC, DG's principal minicomputer competitor, has not been affected by the trend because its VMS operating system, which runs on the company's VAX computer family, has established itself as a standard. The other ruling operating systems are IBM's MVS mainframe system, AT&T-developed Unix, and MS/DOS, the operating system for IBM PCs and compatibles developed by Microsoft Corp.

That means that other manufacturers running proprietary operating systems, like DG, "must run twice as hard," says Peterson. The remedy for DG, she claims, is to "find some new products wherever there is a demand." Peterson cites any new application that was once accomplished on paper and is now being done by computer as a potential area for any disappointed manufacturer. For example, DG should find something now like computer-aided design/manufacturing (CAD/CAM) was in 1981, says Peterson. "Wang [Laboratories] is trying to do that with image processing," says Peterson. The Lowell, Mass., computer maker reported a 72.4% drop in profits but increased revenue 9% in the quarter ending in March this year.

The Prime of life

Prime Computer Corp. is also showing healthy gains despite the same omnipotent threat of DEC that DG faces. The Natick, Mass., mini manufacturer recorded a 13% rise in revenue and a 28% increase in earnings during the first calendar quarter. Prime, which began targeting CAD/CAM a few years ago, is expected to announce its intentions to zero in on another narrow market soon.

Prime is both an investor in and an original equipment manufacturer (OEM) to Cydrome Inc., a maker of so-called minisupercomputers. Prime should be introducing its minisupercomputer offering, based on Cydrome's 64-bit, emitter-coupled logic (ECL) proprietary processors, sometime this summer. Prime will be the first mini maker to enter the new minisupercomputer market, which to date has been populated by recent start-ups, such as Cydrome. The minisuper market — which is comprised of high-end scientific and engineering applications historically run on supercomputers and superminicomputers — is expected to reach $375 million this year, according to Hambrecht & Quist Inc. in San Francisco.

By all accounts, the minisuper market continues to heat up. So far, DEC is addressing the market through a joint marketing deal with Floating Point Systems Inc., the Beaverton, Ore., maker of attached array processors, to increase compute power on its VAX series for a specific set of problems. In addition, DEC is expected to announce a joint marketing and development deal soon with Cray Research Inc., the supercomputer market leader, according to Jeffry Canin, an analyst with Hambrecht & Quist.

The two start-ups with the highest stake in the minisuper market so far — Alliant Computer Systems Corp. and Convex Computer Corp. — both reported impressive first quarter earnings and revenue. Alliant posted $12 million in revenue, three times that of the same quarter a year ago. The Littleton, Mass., minisuper maker's installed base grew 34%, to 110 systems. Convex reported a 92% rise in revenue, to $14.4 million and shipped 30 systems, bringing its installed base to 127 systems.

The mainframe market appears to be picking up some steam, also. Amdahl's Fonner attributes the company's spectacular first quarter results to both sales of its storage products for mainframes, and system sales of its 5890 series mainframes. "And the indications are that we don't see any slackening in demand," says Fonner. Fonner claims that in addition to new account activity, Amdahl is also seeing robust demand from its installed base. "We are seeing repeat business from existing customers much faster than usual," says Fonner.

IBM attributed its better-than-expected first quarter results from mainframe sales. And other mainframe makers, such as Control Data Corp., NCR Corp. and Unisys Corp., that manufacture computers that are not compatible with IBM's systems, also report business is healthy.

The midrange market may be in for a bit of a shake-up, say analysts. Analysts agree that IBM's 9370 minicomputer, announced last October, will have some impact on the midrange market competition. "IBM is going to make a lot of hay with the 9370," says Van Weathers, a business computer analyst with Dataquest Inc., a market research firm in San Jose, Calif. "It looks like a good machine." Weathers says that in addition to strong sales of its 3090 mainframes, IBM is "stirring up a great deal of business," through 9370 orders. And while Digital hasn't lost any steam, says Weathers, the minicomputer maker may experience a slowdown in taking share away from IBM in the business market.

But that may be the only thing stir-

ring in the market. Most mini and supermini manufacturers have filled out their computer families over the past few years and nary a product announcement is expected for the remainder of 1987. Hal Feeney, a technical computer analyst with Dataquest, expects that DEC, DG and other mini vendors to continue to fine-tune existing products.

IDC's Mikita anticipates "some announcements from smaller companies that will be interesting." In the technical market, says Dataquest's Feeney, Dana Computers Inc. and Stellar Computer Inc. should bring out their high-powered workstation offering by year-end. It will be the first introduction for both start-ups, which are expected to pioneer a new market for desktop computers in the high-end technical market.

Feeney projects that both Apollo Computer Inc. and Sun Microsystems Inc. will be offering increased performance on new systems by year-end as "leapfrogging in the technical workstation area continues." Feeney also believes that systems based on Intel Corp.'s 80386, 32-bit microprocessor, will have some impact on the workstation arena this year.

IBM's 386-based system — while setting tongues wagging in the industry — won't be available until the end of the year. While the low-end models 30 and 50 are available now, the top end Personal System/2, the model 80 based on the 80386, is slated for shipment in the last quarter. And the Microsoft Corp. operating system, OS/2, which has been designed to take full advantage of the 386's power, won't be ready until mid-1988. But the switch to 3.5-inch disks and the new systems' bus structure will be sure to have an immediate impact on the PC market as companies rush to market with add-on products.

But one PC market participant isn't panting. COMPAQ Computer Corp., which announced a 386 machine based on the old IBM standard last year, has made its intentions clear. "Over the past several weeks I've started wondering if IBM didn't introduce the computer industry's version of New Coke when it tried to change the formula for its PCs," said Joseph R. "Rod" Canion, COMPAQ's president and chief executive, at a press conference in New York City in April. "Well, at COMPAQ we're committed to sticking with the 'Classic' formula for success in the computer industry," said Canion. □

BY VALERIE RICE

Semiconductors: Time for cautious optimism

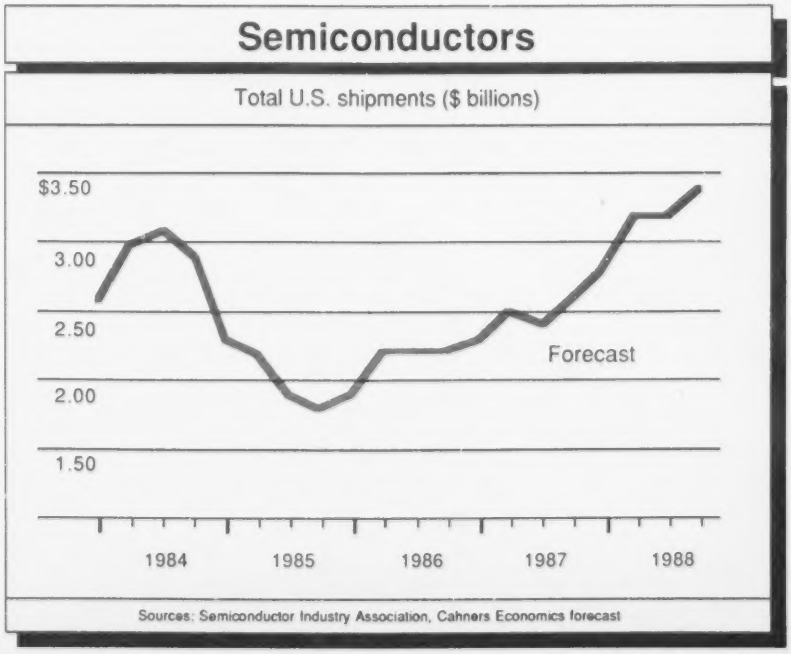
Industry analysts are at odds on the question of how fast the IC market will grow. But grow it will, most predict

The semiconductor industry is back in the black. But a celebration is likely premature, despite evidence that the recent upturn should continue through the rest of the year. The industry, which has taken a beating in the past two years, faces the current revival with caution because, in the words of one senior executive: "It seems like the upturns are shorter than the downturns."

As if afraid to offend the gods, executives whisper cautiously among themselves that things seem to be picking up based on the first half of 1987, and a fearless few dare to say that the industry might get even better in the second half.

Business is indeed better all over, commodity prices are firming and in some cases going up, distributors are seeing more inventory turns, and even the market research firms have raised their forecasts, rather than lowered them.

Dataquest Inc., San Jose, Calif., raised its forecast from the "teens" says senior industry analyst Andrew Prophet, to a 1987 worldwide IC number of 20.5% growth over 1986. Scottsdale, Arizona-based Integrated Circuit Engineering (ICE) raised its forecast as well, predicting 15% worldwide IC growth this year. In-Stat Inc., also in Scottsdale, is well-known for its pessimistic outlook on semiconductor growth (something which has made it relatively accurate in recent years). In-Stat also raised its growth figures to 15%, up from 5.5% originally. In fact, the only industry pundits to downgrade their forecasts were the Semiconductor Industry Association's, they had originally planned on



BY MIKE LEIBOWITZ

Passive components: The recovery is under way

Don't expect a bang-up second half, but there is no question the U.S. component market is strengthening

Manufacturers of passive components and other nonsemiconductor devices are not yet ready to celebrate, but at least they have no reason to be gloomy. Although still on shaky ground, modest growth may finally be returning to the U.S. components industry.

After two lackluster years, order rates for electronic components have gradually increased during the first half of 1987, according to Emmitt Graham, senior vice president at Gnostic Concepts Inc. Graham expects that this increase will continue to accelerate through the second half of 1987 and peak sometime in 1988.

"There's no barnburner out there, by any means, but certainly there is a strengthening recovery," says Graham.

A number of component manufacturers agree that a recovery has arrived. At Sprague Electric Co., Thomas Browne, group vice president for capacitors, reports a positive book-to-bill ratio since the beginning of the year and general optimism. "It looks as if the OEM [original equipment manufacturing] inventories have burned off and we're seeing an upturn in business as a result."

Augat Inc.'s vice president Richard Grubb says that the company has seen some definite improvements in back orders for connectors and sockets. "I really feel that we are back on a track of sustained, solid growth," Grubb says.

Cherry Electrical Products Corp. has seen approximately a 15% rise in sales during the first quarter of 1987 over the first quarter of last year, according to Peter Cherry, president. Cherry is generally optimistic about prospects for this growth to continue. He is concerned, however, that a recovery could be disrupted by continuing trouble in the world economy.

But at Veeco Instruments Inc.'s Lambda Group, Joshua Hauser, executive vice president, says they are still seeing a business climate for power supplies that is "essentially flat." Although he says that Lambda has projected a "modest" growth in bookings in the short term, he is uncertain about the likelihood of continued growth. "Whether this is a sustainable trend or whether it's a little hiccup and we're going to go back into the doldrums is not clear," says Hauser.

> After two lackluster years, the passive component market will continue to accelerate through the second half of 1987 and peak sometime in 1988
>
> Gnostic Concepts Inc.

Lower inventories

Many in the industry agree that a basic factor in allowing a recovery to occur is the whittling down of excess inventory levels that took place during 1986. By the end of 1986, says Gnostic's Graham, excess inventory had virtually been eliminated.

Those that predict continued sales growth for components in the second half of 1987 point to growing production of electronic equipment as the key factor for their optimism. According to Graham, increased demand for computer equipment, in particular, has been a strong motivator in the recovery. He expects this demand to continue its climb into 1988.

For electronic equipment in general, Gnostic Concepts projects that production will grow by over 10% in 1988, up from 7.5% in 1987 and 6% in 1986.

The increase in U.S.-made equipment production is partially fueled by an increase in the value of foreign currencies against the dollar, which makes imported equipment more expensive, and promotes the sales of exports.

U.S. equipment production is also helped by a slowing in the growth in offshore contract assembly, and the relocation of offshore manufacturing back to the United States. Due to increased investment in factory automation in the United States, and more expensive labor costs abroad, "the trade-off between labor costs and capital is no longer a big advantage offshore," says Gnostic's Graham.

Expensive foreign currencies have also helped components manufacturers by making foreign component imports more expensive. At Apple Computer's Fremont, Calif., manufacturing plant, James Bilodeau, materials manager says that Japanese connector manufacturers will not gain

Components

U.S. OEM consumption ($ millions)

	1986	1987	1988
Relays	$682	$697	$724
Switches	562	567	589
Connectors	3,758	3,956	4,267
Capacitors	2,095	2,225	2,302
Resistors	976	1,020	1,048
Printed circuits	4,122	4,361	4,707

Source: Gnostic Concepts Inc.

ground at Apple. "The reason is yen," says Bilodeau. "They've priced themselves out of the market."

The big concern voiced by members of the industry, however, is how the economy will perform over the next six months. A further slowdown in worldwide capital spending during the second half of 1987 could drastically reduce component manufacturers' ability to take advantage of slim inventories and the fallen dollar.

At Hewlett Packard Co., the purchasing department is not planning on a great upswing in business during the next six months. Thomas Cunningham, corporate procurement manager, says that purchases during the second half of 1987 will amount to roughly the same as for the first half of the year, which he says is up a little bit from 1986. The major changes in purchasing activity, says Cunningham, will be from shifts to new technologies, such as surface mount technology.

SMT impact

The move to surface mount technology (SMT) by equipment manufacturers is slow, partly due to the expense of capital equipment and partly due to the lack of a wide range of surface mountable components. Nevertheless, SMT is causing headaches for manufacturers of electronic components. They are required to solve difficult problems in order to address what will undoubtedly be a large future market.

The main technical problem facing components manufacturers is developing products using materials that can withstand the high temperatures of the surface mount process. These temperatures can either cause the component to melt, or cause the circuit board and the component to expand at different rates. In either case, the component fails.

The main marketing problem in attacking the surface mount market — particularly for the connector industry — is the lack of standard surface mount products. Each connector manufacturer is faced with the difficult task of trying to turn their proprietary surface mount product line into an "industry standard."

Despite these problems, components manufacturers realize that the development of surface mount products and other new products is necessary in order to remain on their customer's vendor lists. Equipment manufacturers evaluate their vendors' breadth of product line as one of the criterion used when paring vendor lists and obtaining greater leverage with vendors.

Other criteria important to components customers are price, quality and delivery. In response, components manufacturers are investing in new automated production equipment in order to lower manufacturing costs, improve quality and catch defects before they reach the end of the production line. In line with the move by major customers to requiring just-in-time (JIT) deliveries, many components manufacturers say they will be expanding their JIT capability during the next six months.

The components industry in general has consolidated during the past few years, in order to pool resources and broaden product lines. Additionally, a number of U.S. companies have opened manufacturing plants abroad to follow business overseas.

The main goal for components manufacturers during the past two years has been to put themselves into fighting shape. If the recovery has indeed arrived, their efforts may finally bear fruit. □

Components

U.S. OEM consumption ($ millions)

Microwave components

	1986	1987	1988
Active components	$1,729	$1,981	$2,167
Passive components	4,114	4,502	4,832

Active components: amplifiers, oscillators, tubes

Passive components: ferrite units, connectors, switches and switch modules, filters, antennas, limiters, mixers

Source: ElectroniCast Corp.

Displays

	1986	1987	1988
Cathode ray tubes	$1,402	$1,490	$1,606
Other displays	274	310	366

Cathode ray tubes used for all applications: TVs, terminals, instrumentation

Other displays include plasma, electro-luminescent, vacuum fluorescent, liquid crystal, and multisegment light-emmiting diode. Includes electronics if packaged together

Source: Stanford Resources Inc.

	1986	1987	1988
Power supplies	$4,935	$5,345	$5,825

Source: Micro-Tech Consultants

	1986	1987	1988
Transformers	$2,460	$2,700	NA
Inductors	385	425	NA

Transformers do not include power transmission and distribution transformers above 5 kilovolts

Source: Worltech Reports Inc.

Sensors

	1986	1987	1988
Solid state	$1,400	$1,500	$1,650
Electro-mechanical	922	971	984

Source: Market Intelligence Research Co.

BY ALDEN M. HAYASHI

CAE/CAD/CAM: Still waiting for the upturn

While overseas sales are robust, the U.S. market remains sluggish. One reason: U.S. capital spending has been dismal

When CAE/CAD/CAM systems were first marketed more than a decade ago, they quenched a long neglected hunger. Customers were all but starved for CAE/CAD/CAM (computer-aided engineering/design/manufacturing) systems, which help users automate the design, test and manufacture of products as diverse as computer chips, cars and 40-story buildings. "It was a salesman's dream," recalls John J. Clancy, president of the Manufacturing and Engineering Systems Co. of McDonnell Douglas Corp.

Times have changed. Customers today want more than just newfangled products. They want CAE/CAD/CAM systems that fit into their overall corporate plans for automation. "When people are concerned about those sort of things, they tend not to buy .... Our sales cycle has definitely stretched out way beyond anything we've seen before," says Clancy.

Not surprisingly, the CAE/CAD/CAM industry has slowed. In the early 1980s, the market was speeding along at an average annual growth rate of 53%, according to Daratech Inc., a market research firm located in Cambridge, Mass. Today, however, Daratech is predicting a mere 14% annual growth rate for the next five years. In particular, Daratech says that the market this year will grow only 11.7%, from revenue of $4.0 billion last year to $4.5 billion. And next year the market will grow 16% to $5.2 billion, according to Daratech.

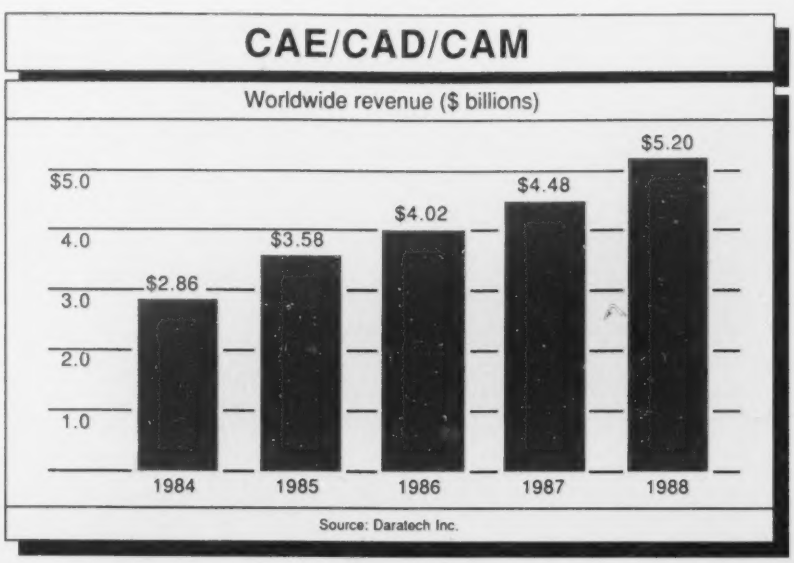
"Before, CAD/CAM was a buzzword and . . . customers would say: 'Oh, CAD/CAM, of course I'll approve the purchase . . .' Now, CAD/CAM has got to fight its way through like any other capital spending purchase," says Patrick Alias, a vice president for sales at Computervision Corp. of Bedford, Mass. CV, like the rest of the CAE/CAD/CAM vendors, reports that sales of its products are now tied to customers' capital expenditure budgets. "We're in the capital spending business," agrees James Meadlock, president of Intergraph Corp., headquartered in Huntsville, Ala.

Dependence on customers' capital expenditure budgets has hurt the CAE/CAD/CAM industry. The predicament of CV customer Varian Associates Inc. of Palo Alto, Calif., is a case in point. When CV introduced new products last year, Varian was impressed. "I liked the new products a lot and I was recommending them to all of our divisions," remembers Don Blackwell, Varian's director of engineering and manufacturing. But Varian did not purchase the products because, explains Blackwell, "we couldn't afford them at the time." Still, Blackwell says that as soon as Varian's capital expenditure budget frees up, he will definitely be buying CV's new products.

But customers' budgets will not be freeing up any time soon, says Timothy R. McCollum, a vice president of Dean Witter Reynolds Inc. of New York City. According to him, overall U.S. capital expenditures will increase by only 1.7% this year, down from 4.0% last year, 10% the year before and 20% in 1984. And for next year, McCollum is predicting a meager 2% to 3% growth. McCollum lists some of the reasons for his pessimistic outlook: low inflation, low factory capacity utilization and the recent tax-law changes. All of these factors, he says, lowers the incentive for customers to purchase equipment.

Because of the pessimistic capital expenditure outlook, Daratech president Charles M. Foundyller says that the competition in the CAE/CAD/CAM industry will intensify. "There's going to be blood on the floor," he predicts. Adds Robert L. Gable, CV president: "The U.S. economy is weak right now in the capital spending area. People are struggling for a declining part of business in the United States." According to Daratech, only three of the top 10 companies were profitable last year: IBM, Intergraph and Mentor Graphics Corp. of Beaverton, Ore. Staying profitable, says Intergraph president Meadlock, is the fundamental problem that faces all CAE/CAD/CAM companies today.

The heated competitive environment will cause bankruptcies, mergers and acquisitions among the myriad of CAE/CAD/CAM companies, contend industry executives. Many feel that the industry is already overcrowded. Indeed, a CAE/CAD/CAM directory published by Dataquest Inc., a market

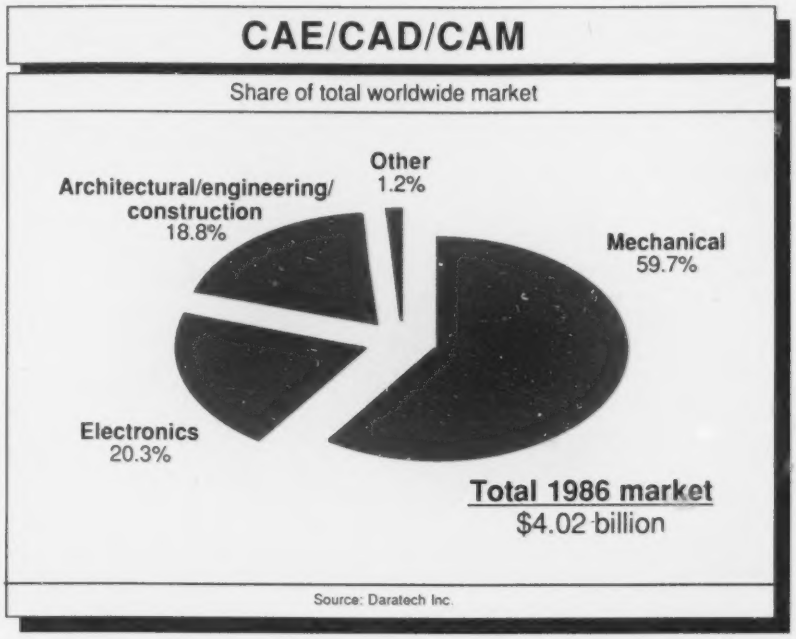


research firm located in San Jose, Calif., lists more than 600 companies in the industry. Consequently, Dean Witter's McCollum has some advice for prospective CAE/CAD/CAM customers: "I'd be very cautious about buying from the small companies."

Earlier this year, Valid Logic Systems Inc. of San Jose acquired Telesis Inc. of Chelmsford, Mass. Says Gerard H. Langeler, Mentor executive vice president: "There'll be more consolidations. There has to be. Too many people are struggling for survival."

In addition, strategic alliances will take place also because CAE/CAD/CAM companies have found that they cannot by themselves supply the complete solution to customers, contends Jerry J. Robertson, vice president for marketing and sales at Applicon Inc., a Schlumberger Ltd. division located in Ann Arbor, Mich. Even mighty IBM, the No. 1 vendor in the industry, admits as much. "No one vendor can really do it all," concedes Robert P. Tiel, head of Big Blue's electronics and architectural/engineering/construction CAE/CAD/CAM efforts.

Strategic alliances and mergers among vendors will also occur because of end users' demands. "Customers want to deal with a smaller number of vendors in a more intensive way," says Philip L. Read, CV senior vice president. Intergraph's Meadlock explains that most customers, even large corporations, are not capable of integrating products from the different CAE/CAD/CAM vendors by themselves.



A price erosion

Although the CAE/CAD/CAM market has been sluggish in dollar volume, unit volumes have soared, claims Daratech's Foundyller. According to him, while the market will grow only 11.7% in dollar terms this year, it will increase by 60% in unit volume. That's terrific, says CV's Alias, except the vendors get paid in dollars, not units. Adds Foundyller: "We're having a great time at the party but the ship has sprung a leak."

The discrepancy between dollar and unit sales is being caused by a huge price erosion in the marketplace. The 1979 average seat price of $180,000 plunged over the next seven years to arrive at $26,000 last year, according to Daratech's figures. Contributing to the decline was the advent of the personal computer which replaced pricier 32-bit supermicrocomputers as the engineering workstation of choice at the low end of the market. CV's Alias says that since 1985, "we came down from $100,000 to $50,000 per seat in about two years."

Alias says that the price erosion has recently slowed and he predicts, "I think it will stop but I don't know when. The rock-bottom price will be at the PC level." Adds McDonnell Douglas's Clancy: "Pricing is the stickiest issue for us."

Look for more strategic alliances and mergers as the CAE/CAD/CAM industry starts to mature, industry executives say

International remains strong

International markets have continued to be the one source of cheer in the CAE/CAD/CAM industry. Sales in foreign countries have remained robust, in part due to the weak dollar which makes U.S. goods cheaper when sold abroad. "The weak dollar has been a Godsend for this industry . . ." says Intergraph's Meadlock.

"The implementation of CAD/CAM now is more rapid overseas," claims McDonnell Douglas's Clancy. Although McDonnell Douglas's overall CAE/CAD/CAM business stumbled last year, the company's overseas sales grew by more than 30%, according to Clancy. He adds that about a quarter of his company's CAE/CAD/CAM business is now overseas.

At other companies, international sales account for an even higher percentage of total revenue. More than half of Calma's electronics CAE/CAD/CAM sales last year came from outside of the United States, according to Bruce Gregory, a senior vice president of this General Electric Co. subsidiary based in Milpitas, Calif. Daisy Systems Corp. of Mountain View, Calif., reports that sales in international markets now account for 50% of the company's total revenue, up from 30% just a couple of years ago, according to Robert Moore, director of marketing. And at CV, the figure is 60%.

But vendors have by no means given up on the U.S. market. "I think '88 could be pretty good. If, in fact, the electronics slowdown really continues through '87, that would have been the third year. That's a long time for it to be down. And at some point, the natural course of economic events is likely to pick it up," says Mentor's Langeler.

Adds CV's Alias: "Customers are *delaying* investments; they are not stopping investments. And they cannot delay orders forever. You can only tighten expenses up to a point. If you want to live, you have to eat." □

BY DAVID CARD

Test and measurement: A return to sales growth

Dragged down by ATE, the market was flat last year. So far, 1987 looks better, and sales will go over $7 billion

It is nothing to write home about, but growth is growth. After an essentially flat year in 1986, the world market for test and measurement instruments should grow more than 7% by the end of 1987. San Jose market research firm Prime Data Inc. estimates 1987 will finish with over $7 billion in sales.

"We'll see some strengthening throughout the year, but not a whole lot," says Prime Data president Galen Wampler. "It won't be a bad year or a great year," he adds. "We scaled back a little because things haven't taken off really fast in the U.S., to say the least."

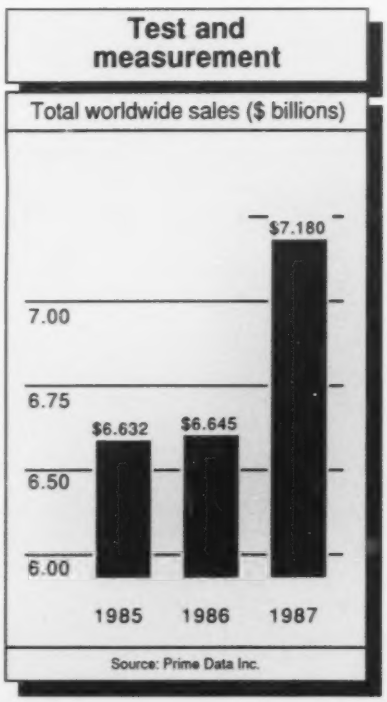
The twin towers of instruments — Hewlett-Packard Co. and Tektronix Inc. — are tracking the industry, while smaller companies are more chipper. For instance, Northwest Instrument Systems Inc. already had a good year in 1986, growing 70% to over $10 million in sales — mostly from its performance analyzers that plug into IBM personal computers. President Lawrence Sutter sees more of the same for the rest of '87. He expects his Beaverton, Ore., company to go well over $15 million by selling to computer and telecommunication companies. To the conventional wisdom that the computer slump has held back participants' equipment spending, Sutter answers: "Well, they're buying our stuff."

At a recent trade show "things were upbeat, compared to the last couple of years," says Dean Dawson, sales manager for Kikusui International Corp. in Gardena, Calif. He claims Kikusui got twice as many sales leads as last year, even though show attendance was slightly down. "Last year, customers weren't very much alive. They were just going through the motions, kicking tires," he says. Kikusui just had its best month in its eight-year history, Dawson says. Sales are 12% higher than last year's roughly $10 million. "That's not the 25% to 26% growth you like to see, but it's all right," he says.

One of Kikusui's strengths, Dawson claims, has been a low-cost digital oscilloscope that has "taken off like gangbusters." As for which end markets are hot and which are not: "Aerospace has never slowed down," Dawson says, "but the rental equipment market is totally dead." He maintains that the rental business has a direct correlation to interest rates — with money cheap to borrow, no one needs to rent.

ATE upturn

Prime Data's Kenneth Neff forecasts a 6% growth in world sales of automatic test equipment (ATE). He cautions that that is "predicated upon continued growth in semiconductor devices." It looks good so far, Neff says, and if things keep up, all that excess capacity the chip makers took on during the 1984 equipment gorging will be used up.



"The semiconductor test side is doing better. They're talking with a lilt in their voices," says Joseph Lassiter, Boston-based Teradyne Inc. board test vice president, concerning his chip test cohorts. Although the board test business was slower to slump and now slower to come back, Lassiter sees good potential sales to makers of add-in boards for IBM's PC AT and an ever-sturdy military market. Military contractors, he says, like to deal on 12-year strategies, and so keep up their equipment budgets.

"The military business is a constant," agrees Brent Bilger, military product manager for component tester LTX Corp. of Westwood, Mass. "That's one of the reasons we're getting in. Maybe if we had a bigger percentage of military business, the downturn wouldn't have been so bad." Bilger adds that military test labs have recently started to buy equipment.

Another constant in ATE is Europe. "Our European business has been carrying us for awhile now," J. Robert Held, vice president of Concord, Massachusetts-based GenRad Inc. says of his board test business. Things hit bottom last year, Held says, but the worst is over.

A yen for stable currency

One of the faster-growing segments, according to Prime Data, is logic analyzers. "The logic analyzer is becoming the general-purpose tool in the lab for digital work, just like the oscilloscope is for analog," Wampler says.

However, a potential end market for logic analyzers that has failed to materialize is in field service. "The philosophy for a long time was to get the technician in the field to do repair," says John Adam, vice president for marketing of Gould Inc.'s Design and Test Systems Division in Cupertino, Calif. "The problem was inventory float, and Federal Express solved the problem." Instead of using logic analyzers to track down and repair malfunctions in computer boards, for instance, technicians merely "Fed Ex" the faulty board back to the factory.

Logic analyzer makers, at least, are not facing one traditional instruments bogeyman — Japanese competition. The Japanese have little presence in

Test and measurement

Worldwide sales by segment ($ millions)

	1985	1986	1987
ATE	$1,722	$1,565	$1,660
Oscilloscopes	912	948	1,040
Microprocessor development systems	521	470	500
Logic analyzers	241	267	300
Other instruments*	3,236	3,395	3,680

*Includes digital multimeters, voltometers and signal generators

Source: Prime Data Inc.

the logic analyzer market as yet, Adam contends. "If they were coming in, I would have expected to see them in two years ago," he says. "And now they would be facing the currency problems. The yen is yet an additional barrier."

Is the strong yen a real issue? "Yeah, it's a problem," admits Frank Orrow, manager of the Instrumentation Department of Panasonic's Memory Systems Division in Secaucus, N.J. Panasonic is a subsidiary of Matsushita Electric Industrial Co.

In Japan, Matsushita is fighting currency inflation across instrument segments with economies of scale. Orrow says the company is forcing oscilloscope prices down by tripling production and thus buying components at volume discounts. Redesigning some models to cut down the amount of circuitry is another tactic.

Likewise, Kikusui's Dawson says that they are "squeezing out everything they can" in Japan. Kikusui buys subassemblies, and is pressuring its subcontractors in order to keep from raising prices. Iwatsu Instruments Inc. is also biting the bullet over the yen. "At this point, there has been no user price changes" in Iwatsu's digital storage oscilloscope, says North American sales manager Alexander Orloff, out of Carlstadt, N.J. "But it's definitely affecting and squeezing margins for everybody."

To host or not to host

Sales of microprocessor development systems (MDS) will not reach their 1985 peak, Wampler says. But that is because suppliers are taking the computers out of them, bringing the dollar numbers, if not the units, down.

Hewlett-Packard is in the process of weaning its customers from a standalone system to one that plugs into its workstation. HP has sold over 500 of its hosted boxes since last summer's introduction, but this compares with an installed base of around 18,000 of the older models. It is all a matter of convincing engineers that an MDS is a system, rather than an instrument, says Fort Collins Engineering Operation marketing manager Brad Miller, in Fort Collins, Colo. "We'll see how that goes," Miller says.

HP's slow shift in MDSs reflects the industry's continuing slow movement in plug-in instruments. A few years ago, PC instruments were predicted to be the next thing, but the market has been sluggish at best. Miller says HP's line of PC instruments "is not our hottest selling by any means," although he concedes that "is where the action is" in MDSs. HP does not yet offer a PC-based MDS.

National Instruments of Austin, Texas, would like to carry the PC instrument to its logical conclusion. National touts what it calls "virtual instruments," created in software. Marketing manager Billy Harris also sells instrument controllers and plug-in instrument boards. He expects that in the long run, digitizer sales will go up, but spectrum analyzer and network analyzer sales will shrink as these instruments are absorbed in software. National Instruments is one of the first engineering-oriented company to jump on the new Macintosh II from Apple Computer Inc.

> The world market for test and measurement instruments should grow more than 7% by the end of 1987
>
> Prime Data Inc.

"I don't deeply believe in hosted systems," confesses Ken Pine, sales and marketing vice president for MDS maker Sophia Computer Systems Inc. in Santa Clara, Calif. Still, Sophia is keeping its options open, particularly through a joint effort with Dolch Logic Instruments GmbH.

Wheeling and dealing

The Dolch deal is less indicative of computer-hosted instruments, than of a general trend toward team-ups. Pine says Sophia was "wholly unsuccessful in Europe" using sales representatives. Dolch gives a ready-made entry to that market, and adds logic analyzers to Sophia's product line. This spring, Gould made a joint-marketing arrangement with Siemens AG. N.V. Philips went one better — it recently announced its intention to buy a piece of John Fluke Manufacturing Co. Inc. to gain smoother U.S. distribution.

Meanwhile, an arrangement with Case Technologies Inc. gives Sophia access to computer-aided engineering (CAE) tools, a double-edged trend of dealing and CAE-connecting. Northwest Instruments cut a deal with Taiwanese emulator supplier Microtek International to expand its offerings in another acronymic market — CASE, for computer-aided software engineering. Both instrument giants — Hewlett-Packard and Tektronix — have internal CAE and CASE efforts that dwarf those of the smaller instrument companies.

Northwest Instruments' president Sutter likes Microtek's speed to market with an emulator for Intel Corp.'s 80386 microprocessor — he claims it beat Intel. Also, Sutter says that Taiwan manufacturing will keep hardware prices competitive and that Microtek has sales clout in Europe.

Finally, start-ups are always good for a little cheery news. Three-year-old Hypres Inc. of Elmsford, N.Y., this year introduced what it claims to be the first commercial product based on Josephson junction technology. These superconductive circuits populate an ultra high end oscilloscope. Late last year, Campbell, California-based Outlook Technology Inc. brought out what amounts to an ultra high end logic analyzer. "This is not the computer industry; you don't create giants overnight," says Outlook president B.J. Moore of his chances for big sales now. At least he has guaranteed shelf space — a handful of reps have invested in Outlook. □

BY JOHN KERR

Computer peripherals: Look for a stronger second half

It's not quite time to break out the bubbly, but printer makers and storage vendors have less reason to complain

They are not exactly breaking out the champagne yet. But halfway through 1987, computer-peripherals makers are cracking a smile or two as some recovery in demand yields a healthier year all around.

It wouldn't be hard to be more upbeat: compared with 1985's ravages and 1986's lull, 1987 is positively popping. But the definition of growth has changed: vendors no longer expect the parabolic sales curves of the early '80s; instead, they are pleased with 15% annual pickup.

Stellar sales of desktop business computers and personal computer-based engineering workstations are spurring much of the peripherals progress. Increasing PC power is itself a catalyst: 32-bit microprocessors like Intel Corp.'s new 80386, now shipping in volume, enable more terminals to be hung on a PC, for instance.

During the first quarter of 1987, nothing caused more ulcers for peripherals executives than the nerve-jangling anticipation of the second-generation PCs from IBM. But the April debut of the Personal System/2 series brought more opportunity than obstacles.

Big Blue's entry

First, the new Big Blue PCs fail to shoot down clone makers, whose demand for everything from enhancement boards to tape drives will continue as a result. Second: open architecture and limited memory on some of the PS/2s underwrite a future for board makers. One company, Orchid Technology Inc. of Fremont, Calif., has already unveiled a memory board which it claims makes it the first independent company to develop add-ons for the Personal System/2s. And more products are appearing daily.

Third: the new PCs come with 3.5-inch floppy disk drives, a definite endorsement for 3.5-inch drives in general. And fourth: the launch of the computers themselves eclipsed the parallel appearance of IBM's first optical-storage product, the heavenly sign long sought by makers of optical drives and media.

The new Macintosh PCs from Apple Computer Inc. are creating a stir of their own; their open architecture is the jackpot that enhancement-board makers like AST Research Inc. of Irvine, Calif., bet on two years ago when they set up divisions to cater to anticipated after-market demand.

Big Macs and Big Blues aside, peripherals vendors are catching wavelets from storms in global-finance fields. Inflation of the yen is hurting Japanese suppliers: "It means a lot to our margins both here and in Japan," says Dennis Flanagan, senior vice president for sales and marketing at printer firm Okidata, a group of Hackensack, New Jersey-based OKI America Inc. OKI has increased its prices 7% as a result.

Another printer vendor, JDL Inc. of Westlake Village, Calif., has staved off the worst of the damage by taking a conservative financial stance early on. It pegged its operations to a 150 yen-per-dollar exchange rate some months ago, but will wince to see it drop below that. Meanwhile, the exchange rate bias in their favor appears to be doing little for U.S. manufacturers.

In general, 1987 is giving disk-drive makers reason to look less beaten. While the business remains competitive to the penny, several players are beginning to show their old stuff again. Chatsworth, Calif., hard-drive performer Micropolis Corp. recently posted a 66% gain in first-quarter earnings on 22% higher sales. Quantum Corp. of Milpitas, Calif., through its Plus Development Corp. subsidiary, is pushing sales toward new highs.

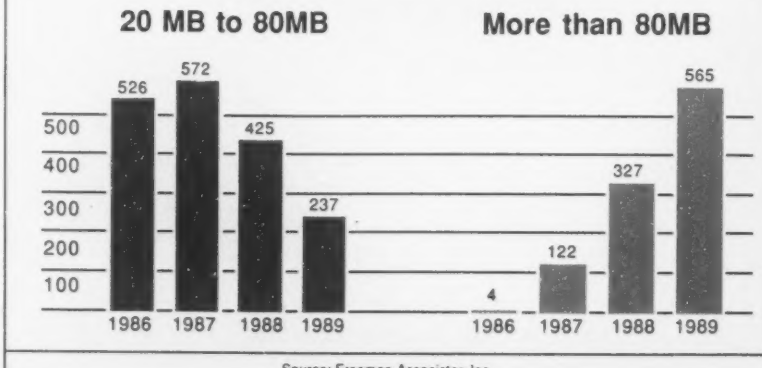
A new spoor is exciting a handful of disk drive hounds: soaring demand for 3.5-inch Winchester drives. "Up, up, up!" is how a jubilant William Schroeder describes his company's prospects. As president of San Jose, California-based Conner Peripherals, a start-up founded last year by disk drive doyen Finis Conner, Schroeder expects to double today's daily production of 1,000 40-MB 3.5-inch drives by this fall.

Schroeder delights in IBM's inclusion of 3.5-inch drives in its new PCs, even though they are floppies. "That's extremely bullish for us," he says. But not directly: the drives are apparently being built by IBM in Japan.

That ought to worry Seagate Technology of Scotts Valley, Calif., 27% of

Cartridge tape drives

Quarter-inch streaming cartridge tape drives worldwide unit shipments (thousands)



Source: Freeman Associates Inc.

whose sales — chiefly 5.25-inch units — have been going to IBM. Although Seagate launched its own 3.5-inch drive this spring, the unit is only being sampled by original equipment manufacturers (OEMs). Seagate feigns nonchalance: "I don't think that demand will shift [from 5.25-inch to 3.5-inch] overnight," says marketing director Carter O'Brien.

Purchasers of the larger drives confirm this. At military computer maker Rolm Mil-Spec Computers in San Jose, peripherals product manager Thomas Russell reports stronger demand for ruggedized 5.25-inch drives as 8-inch units decline.

The trend toward higher disk-memory storage in PCs is lighting up backup tape drives that last year saw disappointing order levels. Says Raymond Freeman Jr., president of market research firm Freeman Associates Inc. in Santa Barbara, Calif.: "As disk capacity goes up, awareness of the need for backup is recognized."

Following industry consensus on standards and endorsement of quarter-inch formats and technical standards by IBM, quarter-inch cartridge tape drives are on the up, according to Freeman: the 80 MB-plus sector is the one to watch, with 1987 shipments of 44,000, up from 4,000 last year. Minicartridge drives, using quarter-inch tape to store up to 40 MB, are also coming into their own in 3.5-inch form factors.

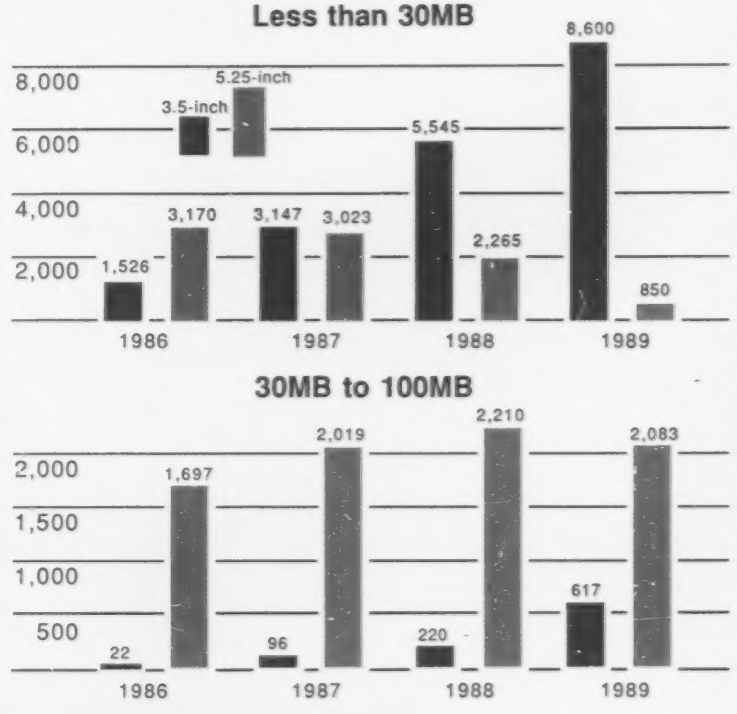
That is music to the ears of tape-drive makers, like Cipher Data Products Inc., and cartridge makers, like Data Electronics Inc., both of San Diego. R. Gordon Root, vice president of strategic planning and marketing at DEI, claims his shipments have doubled to a million units this year.

Cipher Data, which earlier seemed to have stalled in quarter-inch drives, nevertheless showed a 10% to 12% gain in overall sales last year. Its earnings are creeping back up: third-quarter profits, ended March 31, topped $1.3 million versus $954,000 in the second quarter. Cipher has high hopes for the half-inch streaming tape drive — a joint development with IBM — which it will belatedly unwrap this fall. However, the half-inch tape market has yet to make much noise.

Controller boards and chip sets for disk and tape drives are also experiencing a strong tug from customers. According to Vipul Mehta, vice president of market research firm Peripheral Concepts Inc. of Garden Grove, Calif., U.S. controllers manufactured this year will be worth $827 million, topping $1 billion by 1988.

Fixed-disk drives

Worldwide unit shipments (thousands)



This year, 3.5-inch rigid-disk drives outsell sub-30MB 5.25-inch units, and start to make waves in 30MB-100MB sectors.

Source: Disk/Trend Inc.

The optical option

One group of peripherals makers is pinning great hopes on 1987. Manufacturers of much trumpeted write-once optical-memory drives expect their big break this year. "Now that IBM has said that optical is real, everybody's jumping in," says Robert Akers, marketing vice president at Colorado Springs vendor Information Storage Inc. (ISI). Edward Rothchild, chairman of market analysts Rothchild Consultants of San Francisco, has tripled his estimates of write-once drive shipments to 75,000 for 1987.

Buoyed by a development contract for ruggedized 300 MB optical drives from Honeywell Inc., ISI expects to double sales this year to almost $10 million. At the optical-drive division of Laser Magnetic Storage International, also in Colorado, a spokesman points to increasing order sizes, a sign of the industry's coming of age. "Interest in optical is now turning into orders," he says.

In terminals, San Jose-based Wyse Technology continues to prove that demand is dynamic — as long as you give the customer value for money, such as smart terminals, enhanced keyboards or white phosphor screens. Wyse's fiscal 1987 ended March 31 with sales of $250 million, up from $166 million the year earlier. "I think we can do that again. Business is good," says president Phillip White.

The modem arena remains rough-and-tumble, particularly for those trying to do business in 1,200 baud and under product. "It's going to be another tough year, frankly," says Maurice Bailey, sales vice president at Racal Vadic of Milpitas, Calif.

Bailey and others see more thrills

up the baud scale. Prices of 2,400-baud modems are stabilizing as dollar sales reach 25% annual growth rates. Rockwell International Corp.'s Semiconductor Products Division in Newport Beach, Calif., reports a similar upturn for its chip-based 2,400-baud modem "engines." And early demand for Racal's new 9,600-baud units — which use Rockwell modem modules — has helped prop fiscal 1987 sales 10% higher.

Keyboards look better after the battering that sector took in 1985. Digitran, the small Pasadena, Calif., division of Xcel Corp. that concentrates mostly on custom keyboards, reports a 1987 sales jump of over 10%. Key Tronic Corp. expects a 25% increase in unit-shipment growth for fiscal 1988, ending next June 30.

Pricing pressures

Pricing pressure continues, though — at roughly 9% annually, according to Key Tronic's sales and marketing vice president Randy Pierson. That in part accounts for Key Tronic's flat 1987 in both sales and net income, as does persistently unexciting action from mainframe and minicomputer customers that still constitute the bulk of the Spokane, Wash., keyboard maker's revenue.

Output devices remain a mixed story. At the low end, it's no picnic. "In the low end, nine-pin dot-matrix printers are having a rough time," admits Okidata marketing chief Flanagan. Laser printers, averaging 50% annual growth, promise escape to the land of higher profits. Okidata is late to that market: only 5% of sales are sourced from the zippy laser units. But, by this time next year, predicts Flanagan, they could provide 20% of his company's revenue.

PC workstations are fueling fires at Lockheed Corp. subsidiary CalComp, a prominent maker of plotters in Anaheim, Calif. Lawrence Sanders, marketing vice president, cites a 30% step in shipments of CalComp's 1040 plotters to 12,000 units yearly.

At the high end — large electrostatic plotters used by the design shops of aerospace giants — demand has been in the tank because of the capital cost of the equipment, according to CalComp's Sanders. In May, CalComp used new manufacturing efficiencies to cut prices on its big color electrostatics from $100,000 to around $60,000. "We expect to reset the market. In essence we're selling color at monochrome prices," says Sanders.

BY MARK MEHLER

Semiconductor production equipment: No consensus

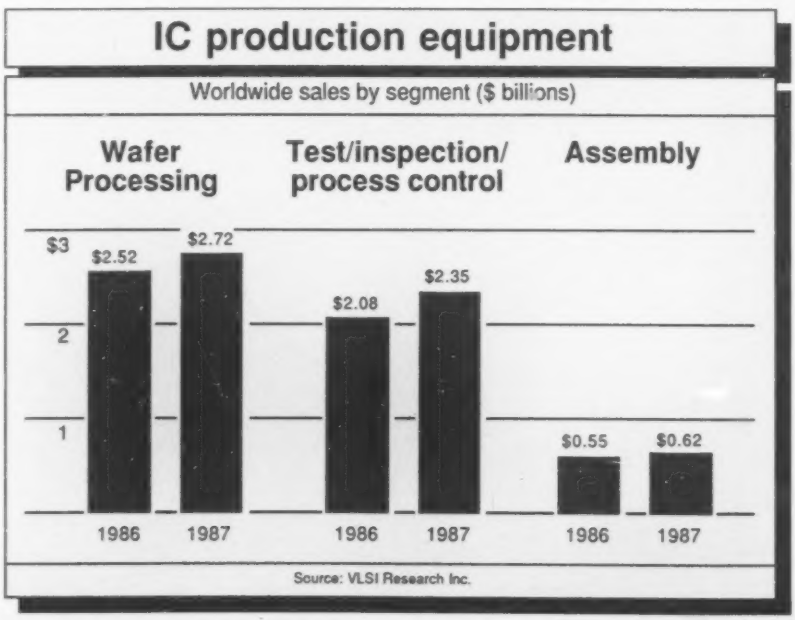
Some analysts are forecasting a sharp rebound in the second half. But other observers are less sanguine

Semiconductor equipment suppliers are ready to close the book on the longest and deepest recession in their history. However, there is a catch. A growing number of observers are questioning the equipment industry's long-term future.

This outlook is reflected in the projections of VLSI Research Inc., a San Jose, Calif., market research firm which sees sales of integrated circuit equipment rising steeply in the third and fourth quarters of 1987. VLSI's G. Daniel Hutcheson says that this year's market for wafer fabrication, test and assembly equipment will reach $5.69 billion, a 10.5% increase over last year's $5.15 billion. Second-half 1987 revenue will hit $3.42 billion, compared with $2.41 billion in last year's six-month period, and $2.27 billion in the first half of this year. Hutcheson adds that equipment book-to-bill ratios will likewise soar in the next six months, reaching 1.9:1 in the third quarter, compared with 0.77:1 in the same period of the previous year.

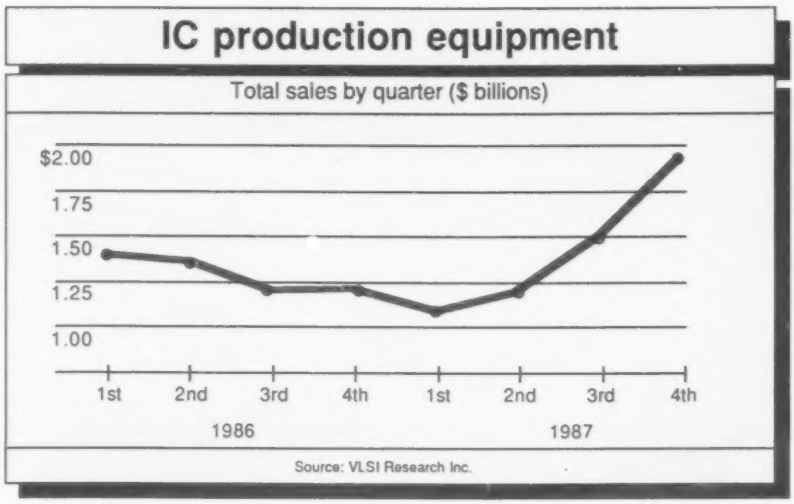
"The personal computer market is already impacting sales of semiconductor equipment," argues Hutcheson. "Intel's microprocessor business, for one, is being driven by the new IBM PCs and the AT. Telecom markets are also strong. This year is looking better." Sidney Hoffman of Josephthal & Company Inc. in Boston says that pent-up demand in the personal computer market could create an overnight explosion on the semiconductor side.

However, observers are nowhere near as sanguine about 1988 or 1989. VLSI Research has just scaled back its 1988 forecast to $5.74 billion, virtually level with 1987. VLSI believes that the semiconductor equipment segment, which is currently "out of sync" with the rest of the U.S. economy, will catch up to a major economic down-



turn late next year. Hutcheson sees book-to-bill ratios dipping as low as 0.47:1 in 1988's third quarter.

Stephen Balog, an analyst at Prudential-Bache Securities Inc., deflated the psyches of some equipment makers at a recent Semiconductor Equipment & Materials Institute (SEMI) luncheon in New York City, by pointing to "serious long-term troubles" for the industry. Balog cited several negative trends, including a slowing of semiconductor device growth from a range of 18% to 19% a few years ago to one of 13% to 14%, due largely to declining growth in the data-processing segment, which consumes nearly one-third of all ICs. Moreover, the analyst noted device makers are being forced by Wall Street to slow capital spending to improve their return on assets. Future growth of the equipment business, Balog suggests, will be equal to, or even lower than, growth in semiconductors, a radical and troubling historical shift.



More bad news

More bad news from Balog: A continued shakeout, fewer start-ups as venture capitalists and corporate investors pull away and, perhaps most critical, an abandonment of the dynamic random-access memory (DRAM) market by U.S. companies, which eliminates a major reason for buying new leading-edge capital equipment. Application specific ICs (ASICs), to which many former DRAM players are moving, do not require the same sophisticated process equipment as 1Mb and 4Mb memory devices, says Balog. Thus, users will have more incentive to optimize existing equipment rather than buy new gear, he concludes.

At the same time as equipment makers face these pressures and many lose control of their balance sheets ("There are quite a few financial basket cases in the equipment industry," says Prudential-Bache's Balog), their customers are weighing in with tougher demands. Richard Aldrich, Intel Corp.'s capital acquisition manager, expects his equipment suppliers to be able "to turn on a dime" when Intel is ready to ramp up. "We're at a crucial point right now," says Aldrich, noting rising IC book-to-bill ratios. "Our suppliers have to have faster response time. No more traditional approach, which was: Give me a forecast and we'll stretch leadtimes as we add capacity. It's a different world. Equipment makers have to work more closely with their own suppliers."

Such comments suggest to some analysts that equipment makers will face the same pressures over the next six months that they faced in the frenzy and subsequent collapse of 1984-1985. "There is a possibility that in 1988 you'll see bookings fall apart and backlogs disintegrate, just as they did the last time," cautions Hutcheson, who had advised clients to be cautious back in mid-1984 and is doing the same in mid-1987.

Equipment makers themselves are witnessing stirrings of a second-half revival, but they recall a similar scenario in early 1986, when an expected turnaround turned to dust. "The feeling around the equipment industry seems to be pretty unanimous that we're experiencing an uptick in bookings," says James Greed, director of technology for General Signal Corp.'s Semiconductor Equipment Group, a broad-line supplier. "However, how long the upswing will last and how we should react are big questions." Greed prefers to view gains in equipment utilization as a long-term plus for the industry. "We have to work with our customers to help them cash in on the gains we've made over the past 18 months," he says. "Over the short term, you might sell fewer pieces of equipment, but the industry is going to be much healthier in the end. We're not about to put ourselves out of business."

Equipment makers themselves are witnessing stirrings of a second-half revival, but they recall a similar scenario in early 1986

As in the past two years, equipment firms offering process technology breakthroughs or yield-enhancement products, rather than simply offering new capacity, are faring best. "If it weren't for our new systems, we would be in trouble," says James Bagley, senior vice president of Applied Materials Inc. — which has introduced new-generation ion implanters, epitaxial reactors and chemical vapor deposition systems during the past 18 months. About 60% of Applied's fiscal 1986 revenue of $149 million was derived from new-generation products, says Bagley, compared with 7% of sales the previous year. "In this environment," he says, "new is what sells."

Still, there is the danger of moving too soon, a product marketing problem that has plagued the IC equipment industry for years. "An example is the deep UV excimer laser steppers coming to market," says Philip Papoojian, vice president for sales and marketing at 2-year-old start-up Voyager Technologies Inc. "At this point there isn't even a deep UV resist available." Papoojian says that Voyager is navigating through the rough waters by offering concrete scientific and economic justification for its product — an automated system to control static in a clean room. "We're selling the idea of getting better usage of the installed base. That's the only way we're going to grow the business in these times." □

BY BRUCE C.P. RAYNER

Distribution: A glimmer of hope in a rising market

While the uptick appears substantive, the mood of distributors remains cautious in the second half

As a rule, distributors are an optimistic bunch. But while a handful of outspoken optimists are heralding the recovery, many remain skeptical. Still, there is no denying that business is strengthening. The question is whether that growth can be sustained.

The main reason for the hesitation is that a similar uptick happened in the first half of last year. Business was improving, sales increased and inventory was rebuilt. By third quarter, though, it was evident that the supposed 1986 recovery had undergone a false start. As a result, many distributors spent the rest of the year getting rid of product by cutting prices and profit margins. Because distributors are loath to get burned again, they are approaching this year's good start with caution.

But, with good first-quarter results from the computer industry, there is every reason to believe this year will be different from 1986. Distributors' bookings and shipments grew by 6% between the fourth quarter of 1986 and the first quarter of 1987, reports Toby Mack, president of the National Electronic Distributors Association (NEDA). And the Semiconductor Industry Association reports that monthly semiconductor book-to-bill ratios rose continuously from October 1986 through March of this year.

Andrew Neff, an analyst with Montgomery Securities in San Francisco, Calif., believes that the distribution industry will grow at an annual rate of 11% or 12% in 1987, from $6.3 billion in 1986 to about $7 billion this year. Neff speculates that much of that growth will be driven by the 32-bit microprocessor revolution, much like the personal computer drove the last electronics boom. He is convinced that the early 1987 upturn in business reflects a real recovery by the computer industry and is not just a speculative buying spree.

Economic and technological changes will play a part in making this rebound a full-fledged recovery, says Mack, who is forecasting a modest but healthy 10% annual growth rate for the industry for 1987. The lower dollar, although having only a limited impact on the trade deficit to date, is expected to have positive consequences as the year progresses. Equally important to distributors is how quickly the new 32-bit microprocessor will become a mainstream component in their customers products. And, for the larger national distributors, the success of application-specific integrated circuits (ASICs) will play a role in their long-term economic health. Most of these effects, however, have yet to materialize.

Cautionary note

Anthony Hamilton, the West Coast-based chairman and chief executive of top-ranked Avnet Inc. and president of Hamilton/Avnet, is not as sanguine as either Mack or Neff: "It appears that the distribution business should grow at least 5% in calendar 1987 compared to 1986 with the strong possibility that for some firms it may be as high as 10% or more," he says. Avnet's sales are increasing "on a gentle basis."

Leon Machiz, the New York City-based president of both Avnet and Avnet's subsidiary Time Electronics, is more of an old guard optimist. He expects both Hamilton/Avnet and Time to post growth rates for the second half of 1987 of between 10% and 15%. He agrees that 1986 was "a false dawn" but says that the improvement in business so far this year is different. "I think we are witnessing a recovery," he says.

Hamilton believes the 1987 upturn in business is being driven partly by a real improvement in the market and partly by a concern for the future availability of Japanese semiconductors. The ongoing trade debacle between the United States and Japan is, indeed, a source of concern and is fueling speculative buying of commodity products. Contributing to this uncertainty was the franchise reshuffle of the top three domestic semiconductor makers late last year. Most industry watchers, however, believe the worst of the musical chairs franchise game is now over. But the ripple effects of these upheavals are still having an influence on short-term buying habits, and the trade war is not expected to subside.

"Business is up, but I wouldn't say it is a recovery yet," comments Bernard Marren, president of Western Microtechnology Inc., one of the few top 20 distributors that carries a full line of Japanese semiconductors. Although business has been improving since October, Marren is not convinced this is a substantial recovery because shipments have yet to catch up with bookings. "People are buying for futures more than for today."

Gordon Marshall, chairman and

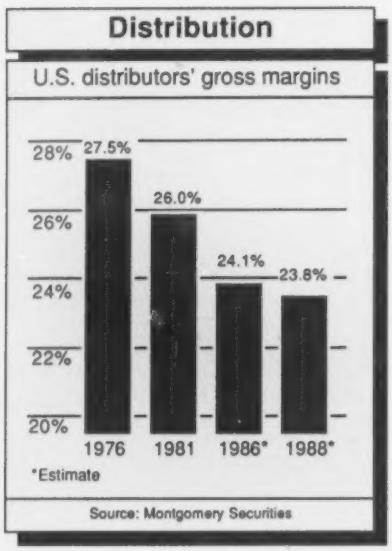
Distribution

Sales by segment ($ billions)

	1983	1984	1985	1986*	1987*	1988*
Semiconductors	$2.30	$3.40	$2.10	$2.20	$2.50	$2.85
Systems	0.95	1.25	1.40	1.80	2.10	2.45
Passives	1.20	1.23	1.20	1.24	1.29	1.33
Connectors	0.85	1.00	0.95	1.05	1.15	1.30
Total	**$5.30**	**$6.88**	**$5.65**	**$6.29**	**$7.04**	**$7.93**

*Estimate

Source: Montgomery Securities



president of eighth-ranked Marshall Industries, which also carries Japanese semiconductor lines, claims to have had a good first half, but he shies away from making forecasts. He believes one advantage to the trade dispute between Japan and the United States has been the stifling of the so-called gray market for foreign chips which frequently infiltrate the American market through unauthorized channels. (In theory, as the market price reaches the fair market value [FMV] — the floor price for Japanese products set during the trade negotiations last year — the grey market disappears.)

"We think we see some evidence that the grey market is slowing down," Marshall says, basing his opinion on what he hears from the street. Most people in the industry agree with Marshall that grey marketeers are having a tough time, but like most illicit operations, there are no statistics to back up the claims. But as the grey market dries up, the legitimate distributors that carry Japanese lines benefit. "The prospects look fairly healthy for Japanese DRAM sales through [franchised] distribution," comments NEDA's Mack.

OEM bookings

Marshall says that business has been picking up since October and insists that the market is experiencing the beginning of the long-awaited recovery. The force behind the upturn, he says, is the stronger original equipment manufacturer (OEM) bookings, the relative good health of the personal computer and peripherals market, and the overall improvement in business. He admits, however, that the recovery is still "spotty."

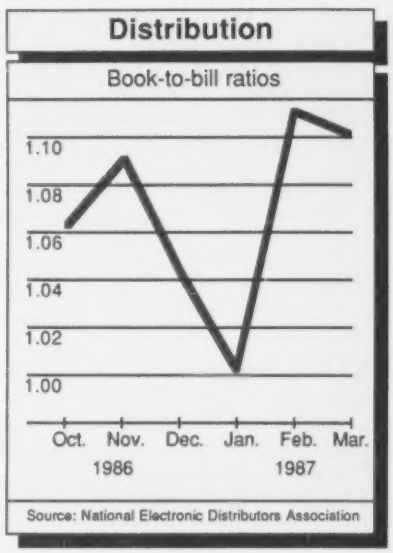
The fastest growing segments for distributors, comments Avnet's Hamilton, are in computer systems and ASICs. Semiconductors will also grow nicely for the balance of 1987, he adds. Machiz insists it will be the 32-bit microprocessor that will drive the recovery in the short term. Most distributors agree that all of these areas are expected to exhibit healthy growth. The military market, although somewhat saturated by increased distributor competition, is also expected to post respectable growth for the remainder of the year.

Stephen Kaufman, president and chief executive of Melville, New York-based Arrow Electronics Inc., the second largest national distributor, reports sales growth for the first calendar quarter of 1987 at a "satisfying" 12%. Although net income is still in the red, Kaufman claims that Arrow is now in the black with its operating income. Arrow's second quarter is expected to show sales growth of between 8% and 10%, he says, whereas the third quarter will be flat and the fourth quarter will be strong. Kaufman, like many of his optimistic competitors, believes that 1988 will be a very good year.

But some are not so easily convinced that the recovery is real. Clarke Walser, a senior vice president with The Chicago Corp., which tracks the distribution industry, says that despite the continued upward trend in sales over the past couple of quarters, he is concerned by the continued pressure on prices and gross profit margins. "I am more encouraged by what I see and hear out there today than I have been for a couple of years, but I think the proof has yet to be shown that this [recovery] is real," he says.

In the tank

This lack of evidence is reflected in distributors' persistent low prices, disappointing inventory turns and sorry gross margins. Prices and gross margins are still "in the tank," says NEDA's Mack, and are at a level that "we can expect to live with for the foreseeable future." Arrow's Kaufman agrees that prices and margins are still "very depressed" but he expects some improvement in the near term. Machiz, on the other hand, believes that prices have already bottomed out in some RAM chips and other commodity semiconductor products.



According to Donald Lupfer, director of distribution for North America for the Electronic Components Group at TRW Inc., prices have continued to erode and distributors' gross margins are razor thin. Lupfer says TRW's ECG sells about $80 million worth of semiconductors, connectors and electromechanical devices to distributors. "I do not think we are out of the woods yet by any stretch of the imagination," he says.

One sign of health, however, is that leadtimes are starting to extend, Lupfer comments. Even though TRW had a strong first half of 1987, he concedes that the third quarter is traditionally slow. "I am satisfied that we are building some backlog and most of our deliveries are stretched out," he says. TRW's leadtimes are creeping out from an average of six to eight weeks to eight to 12 weeks for components; and 12 to 18 weeks for some connectors. He contends that the worst of the three-year dip is over. "People are a little bit more relaxed and a little bit smarter," he says.

Rosmarie Teaters, purchasing manager for Distributed Logic Corp. (DiLog), an Anaheim, California-based company, says she is hearing rumors that prices are on the rise and fears an overreaction from the purchasing community. DiLog, a $20 million company, purchases $3 million worth of semiconductors through distribution a year. "Unfortunately, the electronics industry is so rumor-oriented, it just boggles the mind," she adds, referring to issues such as

the Japanese-U.S. trade war that could set off a round of speculative buying. But, for the most part, she expects prices to remain fairly stable. "I am keeping my fingers crossed that [the buying community] is more mature and that no one is going to overreact to rumors," she says.

Walser at The Chicago Corp. is concerned that if prices, gross margins and distributors' inventory turns do not start increasing soon, then many distributors will suffer when the recovery hits with full force. He estimates that the average distributor only has inventory turns of three times a year: a figure verified by many distributors. With gross profit margins in the low 20% range, he claims that no distributor can earn a satisfactory rate of return on their inventory investments.

As a result, many distributors are finding that they are financially hard pressed when it comes time to build inventory levels to satisfy increasing demand. "I think the industry is faced with a situation where it may well be unable to respond to a resumption of market growth because it doesn't have the capital," Walser warns. As for what might be in store for distributors, he believes that if inventories balloon but gross margins and inventory turns remain depressed, then this recovery could be just another flash in the pan. However, if both gross margins and inventory turns improve, it would be a sign that the recovery is real. □

OUTLOOK UPDATE

BY NORM ALSTER

Telecommunications: Market share is still up for grabs

In almost every segment of the telecom industry, the vendor base has expanded faster than the customer base

AT&T's first quarter report sets the tone for the telecommunications industry in 1987. Yes, when your comparison is with a dismal 1986 first quarter and when you are well into cutting 32,000 names off your payroll, you can show a 25% increase in profits. But no, lower head counts and trimmer tax bills cannot mask the reality of soft demand. AT&T's revenue fell nearly 7% during the first three months of the year. With needed standards for voice/data networks still a blurred and distant target and with loss-plagued competitors desperately hacking prices, large telecommunications equipment companies will depend increasingly on lowered costs. Revenue expansion will not come easy.

Overall, the telecommunications industry is expected to grow by 6% this year, from $142.4 billion to $151 billion, according to International Data Corp. Transmission services such as those provided by AT&T, MCI, US Sprint and regional Bell Operating Companies constitute 87.2% of that sum and with a 6% growth rate essentially dictate the overall market growth rate. Datacommunications equipment, at 3.3% the smallest share of the market, should be the liveliest sector, skipping ahead at a youthful 20% gait. But telecommunications equipment, which includes big-ticket hardware items like central office (CO) switches and private branch exchanges (PBXs), exhibits signs of premature aging, limping along at an estimated 2.8% rate of growth.

The dismal fundamentals of this industry are reflected in three major product sectors — CO switches, PBXs and T-1 multiplexers. In only one of these sectors — T-1 equipment — is the market in an energetic expansion phase. But in all three sectors, the vendor base appears to have grown faster than the customer base.

The PBX environment is especially glum. Harry Rosenthal, telecommunications equipment analyst for Prudential-Bache Securities, says pricing competition among PBX vendors has degenerated into "murderous warfare." Rosenthal estimates that the regional Bell Operating Companies, which act as distributors for such PBX manufacturers as AT&T, Mitel, Northern Telecom and Rolm, lost between $500 million and $1 billion last year.

PBX vendors are faced with a variety of problems. For one thing, the shift from analog to digital systems, a driving force in market expansion two or three years ago, is losing steam. Digital PBXs already account for more than half the installed base. PBXs have also suffered from the repeal of the investment tax credit and the loss of accelerated depreciation in the Tax Reform Act of 1986, says Glenn Powers, senior analyst with Northern Business Information (NBI). The loss of accelerated depreciation hurts PBX vendors more than central switch vendors. The telephone companies that buy office switches can only depreciate at regulated rates, generally 5% a year for 20 years. But private customers would typically depreciate PBXs over seven years, often front-loading the benefits to the first two or three years. The loss of accelerated depreciation makes rapid equipment replacement a less attractive option.

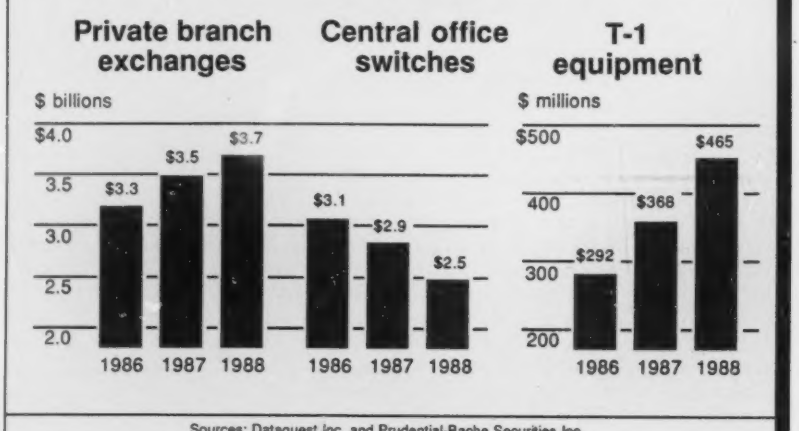
PBX problems

PBXs are also being hurt to some extent by central office switches, according to David Rubin, senior telecommunications consultant with Arthur D. Little, Inc. Until recently, explains Rubin, PBXs were able to offer corporate customers more sophisticated network features than those available through central office switches. But the emergence of Centrex software, which allocates a portion of the central switch to a single private user, has created greater feature parity and siphoned off some PBX demand. NBI's Powers says that Centrex-based services grew by 6% in 1986 and "depressed demand for PBXs slightly."

One of the few bright spots in the PBX industry is long-suffering Mitel Corp. Coming off three years of losses, problems in developing its high-end digital switch, and the termination of a strategic partnership by IBM, Mitel has managed a modest rebound. Sales for the nine-month period that ended Dec. 31, 1986 were $338 million, up from $303 million for the correspond-

Telecommunications

U.S. equipment markets



Sources: Dataquest Inc. and Prudential-Bache Securities Inc.

ing three quarters of the preceding year. Industry observers credit British Telecommunications Plc's purchase of a controlling (51%) interest in the troubled supplier with reassuring customers that Mitel has the resources to continue in the business.

Arthur Franks, assistant vice president of U.S. marketing for Mitel contends that "installed base churning" should be enough to power 6% growth in the U.S. PBX market over the next three years. But Pru-Bache's Rosenthal expects the pricing environment to get uglier as money-losing manufacturers and their distributors seek to administer knockout blows to their rivals.

Like the conversion of analog to digital PBXs, the conversion from electromechanical to electronic CO switches is losing steam. Meanwhile, the conversion from analog electronic to digital electronic CO switches has not yet heated up. Less than 20% of the installed central office switch base at regional operating companies, has been converted from analog to digital, according to Van Cullens, vice president for marketing for Stromberg-Carlson Corp., a subsidiary of Britain's Plessey Co.

With Integrated Services Digital Network (ISDN) standards and implementations still evolving, many operating companies have chosen to wait before going digital. Today, says Anthony Costanzo, market development manager for Ericsson Network Switching Systems in Richardson, Texas, roughly half of 110 million to 120 million access lines in the United States are served by feature-rich analog switches: AT&T's 1ESS and 1AESS machines. Vendors of digital switches will have a hard time matching such features until 1990 or 1991, according to Cullens. Noting that 11.8 million lines were shipped in the United States in 1986, Cullens expects the installation of new CO lines to decline over the next three years to annual rates between eight million and 10 million lines. Dataquest Inc. and Prudential-Bache expect the CO market to contract to $2.5 billion by 1988, down from $3.1 billion last year.

Waning demand, along with the market-cracking efforts of foreign-based firms like Ericsson, NEC, Seimens and Stromberg-Carlson all point to a brutal showdown in pricing. Until the shift to digital picks up around 1990, the foreign firms will be trying to cut deals with the telephone companies to win a foothold for their switch products, developed at costs of hundreds of millions of dollars. The most ominous assessment of the situation comes from Glenn Powers of NBI. "It's a very long-term investment," he says of the European and Japanese firms that have rewritten their code for U.S. switch markets. "None of the companies are here in the short term to make money." Attitudes like that can have nasty implications for the competition.

Switched-on markets

Switch markets may be on hold for now but customers are still looking for ways to reduce the costs of communication. Such savings are a major factor in the growing popularity of multiplexer-based T-1 transmission services.

As large users take advantage of the savings from sending voice and data over private digital lines, sales of multiplexers for T-1 services should expand by 30% to 40% this year, according to Richard Villars, senior market analyst at International Data. T-1 services, which are provided by AT&T, MCI, US Sprint and some of the local operating companies, offer 24-channel lines for high-speed (1.544 million bits per second) digital transmission of voice and data. According to IDC's Villars, a single 24-channel T-1 line generally costs the equivalent of renting four or five public-switched transmission lines.

John Gordon, manager of telecommunications for United Fruit Co., says that his firm has pretty much finished buying PBXs for now, having purchased six systems from Rolm in recent years to replace older rented switches from AT&T. Now United Fruit is looking at the T1 option. The company currently has 20 WATS lines at its corporate facilities in New York City. The monthly bill for these lines, says Gordon, runs between $15,000 and $20,000. Gordon says that his company does not have the high volumes of data traffic that often make T1 services irresistible. Still, he says, the replacement of the WATS lines with a T1 carrier is now under consideration.

T-1 equipment, a $292 million market in 1986, should reach $368 million this year and $465 million in 1988, according to data jointly researched by Dataquest Inc. and Prudential Bache. T-1 multiplexer market leaders include Timeplex Inc., Network Equipment Technologies, General DataComm Inc. and Digital Communications Associates Inc.

But dozens of new vendors and new products boasting ever more efficient voice and data compression (thereby increasing bandwidth) are crashing the only fun party in the industry. Customers' dance cards are becoming very crowded. Thus, Merrill Lynch's interest in purchasing 200 T-1 multiplexers before the end of the year has already triggered "a bidding war" among courting vendors, according to IDC's Villars. "In T-1, the shakeout is beginning," concludes Rosenthal of Prudential-Bache. A.D. Little's Rubin suggests another threat. He expects AT&T to "make a pretty strong comeback" in offering new data networking services later this year that duplicate the efficiency of T-1 and other private networks. □

Utilizing AI in electronics manufacturing

Hitachi and Fujitsu are two companies which are pioneering artificial intelligence applications in Japanese factories

In the use of artificial intelligence (AI) for manufacturing, the electrical machinery manufacturing, which includes the computer and electronic equipment, continues to lead the way in Japan. That's the conclusion of a recent survey by the AI Demand Subcommittee, a group affiliated with the AI Vision Committee which, in turn, is jointly run by the Institute for New Generation Computer Technology (ICOT) and the Japan Information Processing Development Center.

Expert systems, the most frequently cited form of AI, are most frequently used in two types of departments, the survey indicated: development and design; and production control. In the former category, expert system applications include the design and development of everything from large-scale integration circuits, to switching power supplies, to die-cast process design, to computer room layout. In the production control area, the chief applications include solving problems related to ion injection in semiconductor manufacturing, diagnosing communications equipment failure, scheduling of resource allocation in a computer environment and manufacturing process control.

At the same time, marketing departments at many multinational companies are using expert systems to configure large-sized computer systems, as well as large-scale inductive electric motors. In addition, expert systems are used by engineering management to develop proposals for the various user systems. And administration departments are even employing expert systems to determine the correct protocol for welcoming visitors to the company, depending on their title and the nature of the business which they wish to discuss.

In addition, technical publishing departments at these high-tech firms are also developing machine translation systems, another form of AI, for translating manuals, patents and other multilingual kinds of paperwork.

Expert systems, too, are increasingly being used in graphics and image processing. Production and control departments, for example, are now using AI techniques to check printed circuit board (PCB) patterns for malformations or misprints. Further downstream in the production process are so-called intelligent robots, which use AI to drill printed circuit boards or cluster control mechanisms in a factory environment.

Computerized applications

In the computer industry, Hitachi Ltd. and Fujitsu Ltd. are fairly representative of the intense amount of activity that is now occurring in major corporations throughout Japan.

An insider at Hitachi has told ELECTRONIC BUSINESS that there are 120 AI projects now under development in his division alone. That tally also includes AI projects currently under development for customers. For customers in the nuclear industry, for example, Hitachi has already begun to use its in-house developed integrated nuclear plant computer-aided engineering (CAE) system in which, last year, it combined the techniques of atomic power plant design, manufacturing, knowledge engineering, and three-dimensional CAE/CAD computer graphics.

Hitachi is also said to have succeeded in developing production-oriented AI applications, including an automated materials-handling system for Kawasaki Steel. The on-line system reportedly allows nonprogrammers in a production floor environment to program equipment in one-third the time previously employed.

In still another application, Hitachi has devised an automatic train operation system for the Sendai City north-south rail line, which has been modeled after the operational procedures and ways of thinking used by skilled train operators.

Fujitsu also is heavily involved in AI. "We are promoting 75 projects within our computer division," one manager of AI development reports. The other computer divisions at Fujitsu, meanwhile, are running 75 additional operations. These applications include AI systems for production planning, material selection, technical consultation, design support and even ways to improve navigation. The multinational electronics firm has even built a computer-assisted scheduling system which incorporates 241 "if-then" rules (divided into 28 knowledge groups), 12 types and 218 LIPS (logic instructions per second) processing capability.

SHOHEI KURITA